Natural Resources Canada | Ressources naturelles Canada

EARTH SCIENCES SECTOR

2004 Update and Progress Report
2002/2005 Business Plan

Canada

105-05914/

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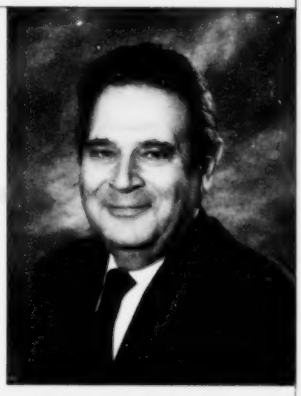
MESSAGE FROM THE ASSISTANT DEPUTY MINISTER



I am pleased to introduce this *2004 Update and Progress Report* to the Earth Sciences Sector's (ESS) *Business Plan 2002/2005*.

The purpose of the update is to provide current information regarding the organization, programs and activities of the Sector. This update does not replace the *Business Plan 2002/2005*. Rather, it complements it by providing more recent information than what was available during the preparation of the three-year Plan.

I am very proud of the exceptional effort made by Sector staff over the last two years to implement the ESS S&T Strategy. As a direct result of that work, the Sector's programs and related activities are essential components of the science and technology (S&T) Canadians need to make informed economic, social and environmental decisions. As such, ESS continues to make a significant and fundamental contribution to the quality of life of Canadians through innovations in geoscience and geomatics.

This *2004 Update and Progress Report* confirms that in implementing the ESS S&T Strategy, the Sector has not lost sight of its vision. Specifically, that vision is to be, and be recognized to be, a leader in the development, deployment and integration of S&T into policy and decision-making by Natural Resources Canada, the federal and provincial governments, industry and other stakeholders.

ESS continues to strive to be a high-performance, issues-, outcomes- and outputs-driven organization, known for excellence, recognized as an employer of choice, aligned with government priorities and linked to other parts of Canada's innovation system.

As an S&T organization, it is important that ESS invest in innovative, original, high-risk S&T in order to maintain a balanced portfolio. Therefore, I have created an ESS Ventures Fund, which will support highly innovative/high-risk activities including, but not limited to, proof-of-concept studies, new methodologies, new forms of delivery and new products aligned with current or anticipated government priorities.

Partnerships are essential to the way that ESS delivers its programs. The Sector works with a variety of partners including governments, industry, educational institutions and individual Canadians to help them meet the challenges of competing in a fast-paced, technology-driven world economy.

The future is challenging, bringing with it an on-going responsibility for relevance, effectiveness and efficiency to the manner in which we develop and deliver our programs.

I believe that by implementing the ESS S&T Strategy, the Sector has never been better positioned to respond to the priorities and issues of our government in particular, and Canadians in general. I will work with staff and stakeholders to ensure that ESS continues to demonstrate leadership in the provision of timely, relevant world-class geoscience and geomatics information and services.

I look forward to publishing a comprehensive ESS Business Plan for the 2005/2008 planning period during FY 2004/2005.

Both the *2004 Update and Progress Report* and the *ESS Business Plan 2002/2005* are available on the ESS Web site at: www.nrcan.gc.ca/ess/index_e.php

Irwin Itzkovitch, Ph.D.
Assistant Deputy Minister
Earth Sciences Sector

1.0 INTRODUCTION

THE EARTH SCIENCES SECTOR (ESS) OF NATURAL RESOURCES CANADA (NRCan) IS A RECOGNIZED WORLD LEADER IN GEOSCIENCE AND GEOMATICS. THE SECTOR WORKS IN PARTNERSHIP WITH GOVERNMENTS AT ALL LEVELS AND WITH CANADIAN INDUSTRY AND UNIVERSITIES TO PROVIDE THE KNOWLEDGE AND EXPERTISE CANADIANS NEED TO UNDERSTAND CANADA'S LANDMASS, MANAGE INTELLIGENTLY THIS COUNTRY'S RICH NATURAL RESOURCES, AND CONTRIBUTE TO THE WELL-BEING OF PRESENT AND FUTURE GENERATIONS.

Section 2 of this plan describes the environment that shapes the Sector's business. Section 3 outlines key government issues the Sector is addressing and the programs for the 2002/2005 planning period, updated to 2004, including a progress report on how the Sector is delivering science and technology (S&T) services and products. This business plan update also contains information concerning linkages with partners and stakeholders, and an organization chart for ESS.

People Are Our Strength

The success of any organization is related to how it attracts, retains and develops its human resources. ESS's culture is one of cooperation, teamwork, shared values and ethics, and empowered action. To ensure that ESS is, and is seen to be, an employer of choice, the Sector is committed to creating and maintaining a knowledgeable, diverse, innovative and representative work force by the effective development, recruitment and retention of its human resources.

In July 2003 a framework for Human Resource (HR) Planning in ESS was developed to guide the Sector in the implementation of its HR strategic plan.

Accountability within the Sector

ESS's Governance Document describes primary responsibilities and accountabilities for the Sector's management. The Assistant Deputy Minister (ADM) is accountable for providing the vision, leadership and management of the Sector's programs and human resources. The ADM is also responsible for providing input into departmental issues, and for providing the highest quality support, issues and management advice to the Deputy Minister and the Minister.

ESS Directors General (DGs) and Directors are responsible and accountable for ensuring that the strategy, philosophy and vision are well understood and translated into action. ESS DGs are jointly and severally accountable for outcomes and outputs of programs conducted within the Sector.

Directors are accountable for providing strategic leadership for their Division (a Centre of Expertise and "home base" for staff). Directors are also accountable for providing the care and nuturing of the people and physical assets entrusted to their Division, and for creating a supportive environment that promotes diversity, equity, personal growth and creativity.

Program Managers are accountable for the delivery of the approved outputs and specified outcomes of their Program and for ensuring, through their Project Leaders, that the projects are delivered on time and within budget.

Sustaining a Quality Organization

ESS seeks and achieves innovation in its program delivery and interactions with its clients, stakeholders and partners by applying the principles associated with high-performance, quality organizations. Acknowledgement of this achievement includes international recognition, and certification, such as the International Organization of Standardization (ISO) certification of the Sector's Management and Administrative Services Division, Centre for Topographic Information Sherbrooke, Geodetic Survey Division, Aeronautical and Technical Services, Centre for Topographic Information Ottawa and ESS Info.

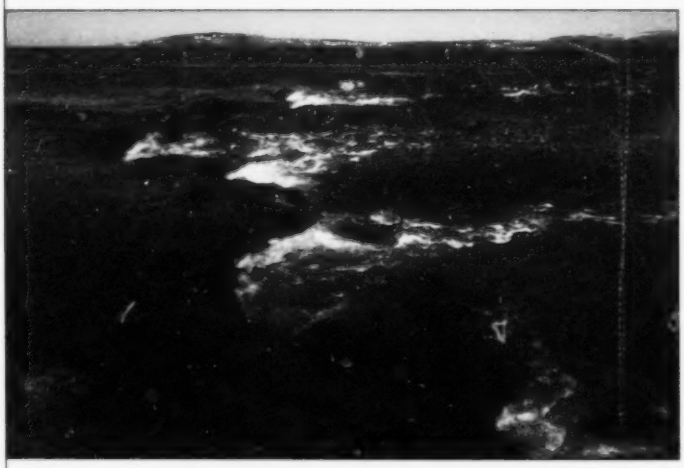
2.0 The Environment That Shapes Our Business

NRCan HAS A LEGISLATED MANDATE TO PROMOTE THE SUSTAINABLE DEVELOPMENT OF CANADA'S NATURAL RESOURCES TO MEET THE NEEDS OF CANADIANS TODAY, WITHOUT COMPROMISING THE QUALITY OF LIFE FOR FUTURE GENERATIONS.

To meet its mandate and the requirements of good governance, NRCan has identified, within its Performance Measurement Framework, five strategic outcomes that provide direction to the Department. These outcomes are:

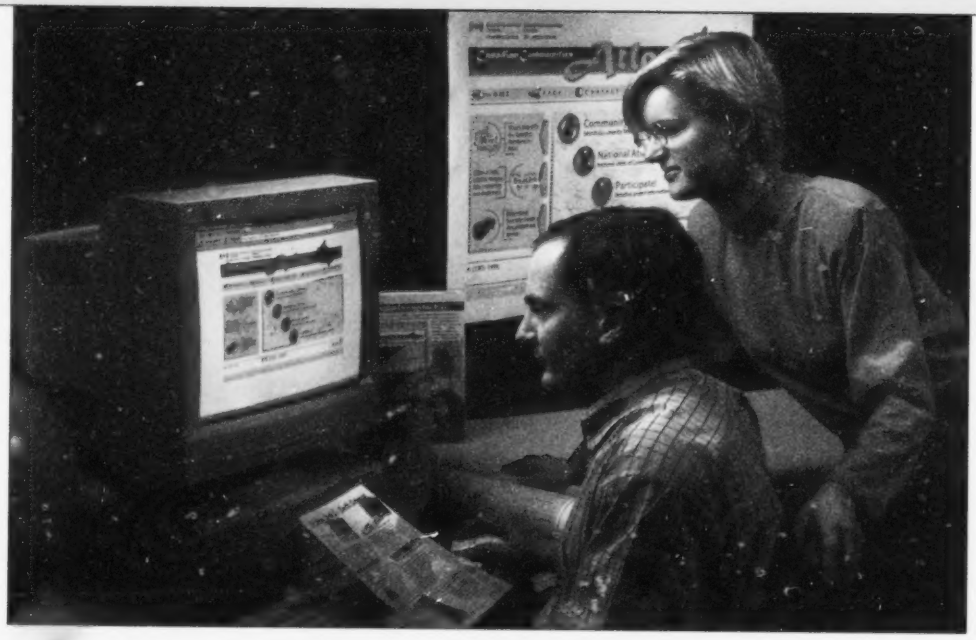
- To provide Canadians with information to make balanced decisions regarding natural resources
- To sustain the economic, social and environmental benefits derived from natural resources for present and future generations
- To provide strategies that reduce the environmental impacts in the natural resources sector
- To provide Canadians with safety and security in the natural resources sector
- To manage the Department efficiently and effectively

In order to participate effectively in the attainment of these outcomes, and to meet current and future government priorities, the Sector has developed and implemented the ESS S&T Strategy.



ESS's Strategy

- Have and maintain a highly motivated, innovative and focused staff;
- Have a balanced S&T portfolio;
- Do the right S&T and do it at the right time;
- Own only what is necessary; influence all you can; and
- Use the best resources wherever they exist through the use of internal and external networks, partnerships and alliances.



ESS is an S&T organization that does research and development, as well as related scientific activities, such as data collection and archiving of cadastral survey acquisitions, Earth Observation imagery and topographic mapping. These activities support the collection and conversion of data into information and, eventually, knowledge. The Sector is also responsible for the maintenance of the national Geodetic Reference System, the national Earthquake Monitoring System and the Canada Lands Survey System. Its roles and responsibilities touch upon issues, many of them horizontal, throughout NRCan and other government departments and agencies. Through its programs, activities and professional relationships with partners, including government, academia, industry and other stakeholders, the Sector is a key contributor to innovation in Canada.

Essential information about the Sector's operating environment is provided through informed advice from various sources, including the Minister's National Advisory Board on Earth Sciences. In addition, through its involvement in organizations such as the federal Inter-agency Committee on Geomatics, the National Geological Surveys Committee and the Canadian Council on Geomatics, ESS plays an important role in promoting and facilitating cooperation among federal departments and agencies and the provinces and territories involved in the creation and dissemination of authoritative geospatial (geomatics and geoscience) information. ESS recognizes that providing the right S&T at the right time is paramount to input to sound policy and decision-making. To that end, ESS ensures that its research and related scientific activities:

- Support government priorities and the Minister's mandate
- Are issues-, outputs- and outcomes-driven and at the same time are integrated into long-term planning and policy
- Have a wide degree of buy-in from stakeholders and users

Have a reasonable probability of technical, policy and economic success

Are in phase with stakeholders' timetables

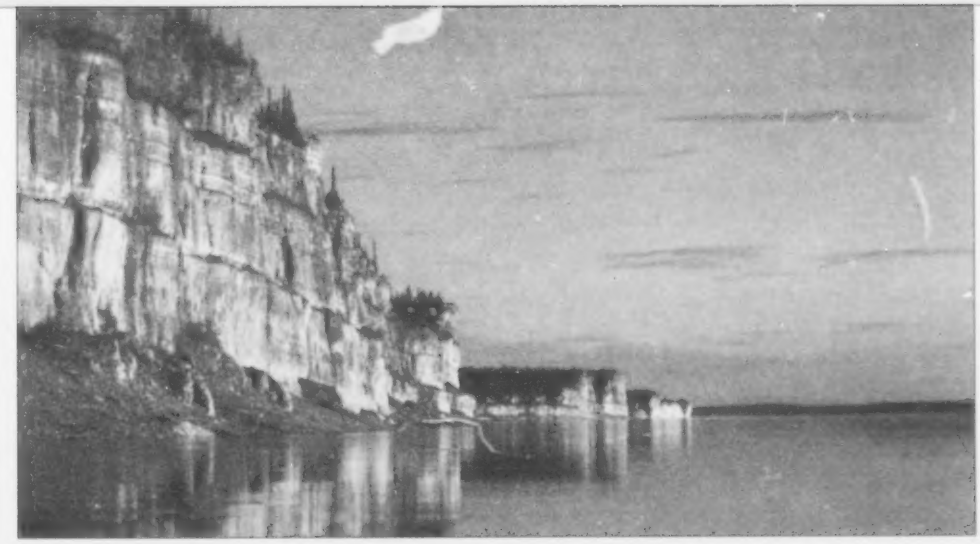
The Sector contributes to a large number of government-wide priorities through its provision of S&T knowledge, services, technologies and human-resources training.

ESS is a flexible and responsive organization. It ensures its activities are relevant by maintaining an ongoing watch on government priorities. For example, the Sector routinely reviews and assesses the priorities described in the Speech from the Throne, the federal budget, etc. as related to its S&T mandate and priorities.

As a result, ESS programs not only address such priorities as sustainable development, but are also attuned to issues involving the health and well-being of Canadians, the environment and the economy that can benefit from the application of timely, authoritative geospatial information as input to the public policy agenda.

The Sector monitors current government issues and priorities, constantly analysing emerging issues for changes in long-term government direction and policies. As a result, it is able to better position itself as a contributor to the identification of issues and priorities, and to provide the necessary information and solutions to support sound decision-making in the resolution of these issues and priorities.

Sustainable development is the cornerstone of Canadians' quality of life, now and in the future. The Sector provides essential S&T information to make sound decisions regarding the sustainable development of Canada's natural resources.



For the 2002/2005 planning period, the Sector is delivering programs to address the following seven priority issues:

- A Clean Environment
- Strong and Safe Communities
- Connecting Canadians
- Sustainable Development of Natural Resources
- Development of the North
- Aboriginal Peoples
- Global Opportunities/Trade and Investment

In addition to these seven priority issue-driven programs, the Sector is also responsible for ensuring the delivery of three national initiatives:

- Climate Change – Impacts and Adaptation
- GeoConnections
- Polar Continental Shelf Project

Six ESS Knowledge-based Services, provided across federal government departments by the Sector, support the provision of timely, accurate information:

- Earth Observation Data Services
- Canadian Geodetic Service
- Canada Lands Survey System
- National Earthquake Monitoring System
- Geomagnetic Monitoring Service
- Nuclear Test Ban Treaty Monitoring

There are a number of overarching issues of importance to Canadians, such as innovation, that are also addressed by Sector programs.

Section 3 describes business plan priorities for 2002/2005 by issues, programs and outputs, updated to 2004, including a progress report. Target outcomes over the longer term are also provided.

Figure 1: Earth Sciences Sector Programs, National Initiatives and Knowledge-based Services Address Canada's Priority Issues

Issue: Clean Environment
(Notional funding 3 yrs: $35.7 M)

Programs

- Groundwater
- Reducing Canada's Vulnerability to Climate Change
- Metals in the Environment
- Legislated Environmental and Resource Assessments

Issue: Global Opportunities/Trade and Investment
(Notional funding 1 yr: $228 K)

Program

- Global Opportunities

Issue: Development of the North
(Notional funding 3 yrs: $100.6 M)

Programs

- Northern Resources Development
- Geomatics for Northern Development

Issue: Strong and Safe Communities
(Notional funding 3 yrs: $75.4 M, including Aeronautical $7.5M Revolving Fund funding per yr.)

Programs

- Natural Hazards and Emergency Response
- Aeronautical Charting
- Canada/United States International Boundary Maintenance and 1925 Treaty Implementation

Issue: Aboriginal Peoples
(Notional funding 3 yrs: $51.3 M)

Program

- Geomatics for Aboriginal Property Infrastructure

ESS
Sustainable
Development

ESS-led National Initiatives
(Notional funding 1 yr: $31.6 M)

Programs

- GeoConnections
- Climate Change Impacts and Adaptation
- Polar Continental Shelf Project

Issue: Connecting Canadians
(Notional funding 3 yrs: $52.5 M)

Program

- Geomatics for Connecting Canadians

Issue: Sustainable Development of Natural Resources
(Notional funding 3 yrs: $141.6 M)
(*TGI funded for 2 yrs: $7.4 M)

Programs

- Consolidating Canada's Geoscience Knowledge
- Geoscience for Oceans Management
- Sustainable Development through Knowledge Integration
- Geomatics for Sustainable Development of Natural Resources
- Gas Hydrates – Fuel of the Future?
- Targeted Geoscience Initiative (TGI)

ESS Knowledge-based Services
(*Notional funding 1 yr: $12.2 M)
(**Currently funded from the Natural Hazards and Emergency Response Program)

Programs

- Canada Lands Survey System*
- Canadian Geodetic Service*
- Earth Observation Data Services*
- National Earthquake Monitoring System**
- Geomagnetic Monitoring Service**
- Nuclear Test Ban Monitoring System**

3.0 Issues, Programs and Progress on Results

ESS PRIORITIES DURING THE PLANNING PERIOD ARE DESCRIBED BELOW BY ISSUE, PROGRAM AND OUTPUT RESULTS TO DATE. EXPECTED RESULTS (OUTCOMES) FOR CANADIANS OVER THE LONGER PERIOD ARE ALSO INCLUDED. FOR EACH ISSUE IDENTIFIED AS A PRIORITY, THE SPECIFIC SECTOR PROGRAMS THAT ADDRESS THE ISSUE ARE SUMMARIZED. THE ORGANIZATION DELIVERING THE PROGRAM WITHIN ESS IS INDICATED IN BRACKETS FOLLOWING THE PROGRAM NAME, AS FOLLOWS: GEOMATICS CANADA (GC), GEOLOGICAL SURVEY OF CANADA (GSC) AND THE POLAR CONTINENTAL SHELF PROJECT (PCSP). KEY QUESTIONS CANADIANS ASK ABOUT THESE ISSUES ARE INCLUDED TO PROVIDE THE CONTEXT FOR EACH PROGRAM.

As well as the 18 core programs, the Sector is responsible for three ESS-led national programs and six ESS Knowledge-based Services also described in this section.

Groundwater (GSC/GC)

A Key Question Canadians Ask:

How do we ensure that we have access to a lasting, abundant supply of clean water?

As a result of this program, major Canadian groundwater aquifers will be mapped and research undertaken on aquifer dynamics to help ensure clean and sustainable groundwater and to fill gaps in knowledge with respect to groundwater resources in Canada. This is being undertaken in partnership with other federal departments, the provinces and territories, and other stakeholders.

Priorities for geoscience, identified through national consultations that led to the creation of the Canadian Framework for Collaboration in Groundwater, include the development of a Canadian inventory of groundwater resources and assessing regional aquifer dynamics, such as recharge and discharge; estimation of sustainable yield; and quantification of vulnerability.

Budget for FY 2003/2004: $3.1 M

Actual expenditures FY 2003/2004: $2.7 M*

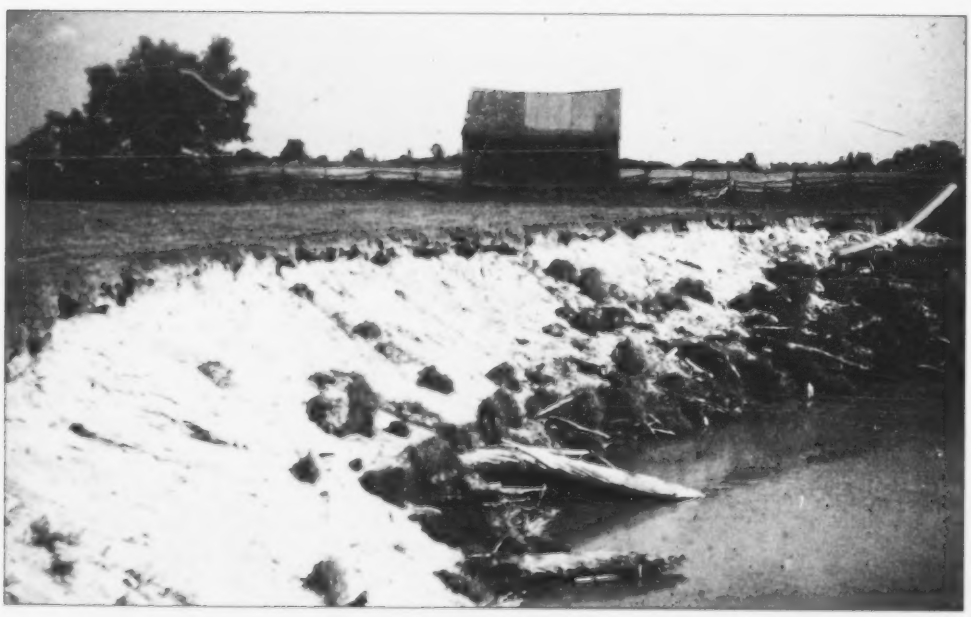
Committed Outcomes

Governments use hydrogeological information to assess the quality and sustainability of key aquifers

Municipalities use information on aquifers at risk to make water- and waste-management decisions

* Expenditure numbers for all programs are preliminary estimates as of May 2004.

Committed Outputs	Results Accomplished to Date
National data base of aquifers and groundwater characteristics	The ESS groundwater data base is being populated with complete assessments of regional aquifers studies undertaken by the Sector. Provinces and territories have agreed to share their groundwater data and information, which will be included in the national groundwater data base. Consensus has been reached on a set of standards to support groundwater data.
20 percent of key regional aquifers mapped by 2006	One-third of the six key regional aquifer "maps" promised for 2006 have been completed. Four municipalities north of Montréal are using the results of the ESS aquifer assessment (data base and numerical model) to design their land-use and aquifer protection plans. Conservation authorities and municipal planners in Ontario will use results from the Oak Ridges Moraine aquifer assessment.



Reducing Canada's Vulnerability to Climate Change (GSC/GC)

A Key Question Canadians Ask:

As the climate changes, what will happen, and what can we do about it?

The goal of the ESS Climate Change program is to reduce the vulnerability of Canadians, their communities, and the country's infrastructure to climate change. This goal will be achieved through conducting and publicizing research aimed at an improved understanding of the sensitivity of Canada's landmass and coastal areas, and through the incorporation of new knowledge in planning and resource management.

The program's six projects are linked by common themes, including landscape and ecosystem vulnerability. The project study areas overlap geographically and share common socio-economic aspects.

Budget for FY 2003/2004: $4.6 M

Actual expenditures FY 2003/2004: $4.6 M

Committed Outcomes

Canadians are better able to adapt to impacts of climate change

Geoscience data are used in estimating the cost of climate change and to inform debate about new Kyoto targets

Committed Outputs	Results Accomplished to Date
Landscape sensitivity data bases	Process models were identified and tested for permafrost and ecosystem sensitivity. Baseline data sets were collected for impact studies regarding permafrost (Mackenzie River Basin) and rising sea levels (New Brunswick and Roberts Bank, British Columbia).
Models of landscape response in key regions and methods for assessing potential for carbon storage	Computations of the complex interactions between ecosystems and the atmosphere (radiation, energy, water, carbon, nutrients) were completed and the results tested.
Municipal impacts of climate change and best-practice guidelines	Collaborative studies were initiated in five municipalities in British Columbia, Alberta, Quebec and New Brunswick. Information session and panel discussion were organized for the annual conference of the Canadian Federation of Municipalities.
Reports on Canada's vulnerability to climate change for national and global climate-change assessments	Established links with scheduled assessments at national and international levels. Contributed to planning these assessments and identified contributions by the ESS program.

Metals in the Environment (GSC)

A Key Question Canadians Ask:

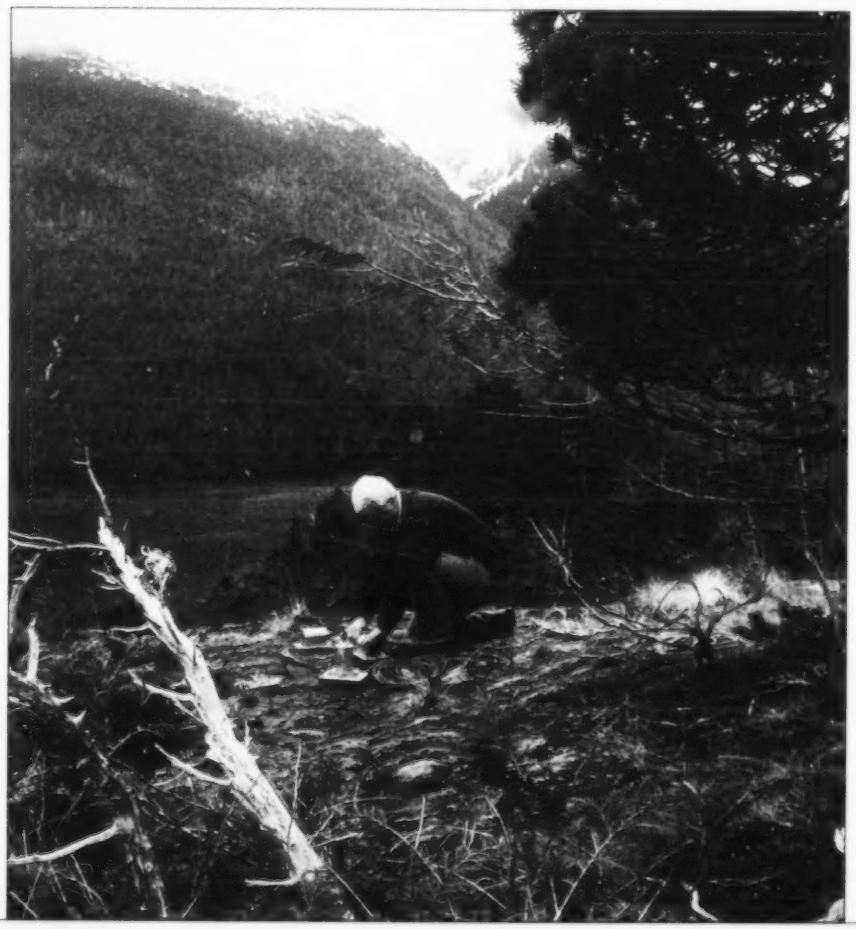
Do metals in the environment pose a risk to our well-being?

This program supports the assessment and management of ecosystem and human-health risks posed by metals in the environment. It does so by informing regulations and risk-management decisions with an improved understanding of the presence of metals in the environment, the source apportionment (human vs. natural), the processes controlling the concentration levels, their availability to enter the food chain and historical accumulation trends.

The program develops links at the policy level with other government departments including Health Canada, Environment Canada, Department of Fisheries and Oceans, and Agriculture and Agri-Food Canada.

Budget for FY 2003/2004: $1.5 M

Actual expenditures FY 2003/2004: $1.3 M



Committed Outcomes

- Risk assessments (e.g., under the Canadian Environmental Protection Act) are informed by an improved understanding of background levels, source apportionment and historical accumulation trends
- Increased expert and public awareness of importance of natural sources of metals in the environment and the related geochemical processes

Committed Outputs	Results Accomplished to Date
Publications describing geochemical variation of background levels of metals in surface materials, processes controlling that variation and mitigation of potential effects	Geochemical maps of Canada, derived from the National Geochemical Reconnaissance Program, have been prepared for release in the National Atlas. Maps and statistics illustrate the spatial variation in element concentrations across the surficial environment of Canada. The spatial variations are explained in terms of the underlying geology.
Identification of areas where natural geochemical variations pose a risk to ecosystem health, food or water quality	The GSC is working with other government departments to provide information on the background concentrations of elements in water and soils. A report has been provided to Environment Canada on background concentrations of elements in Canadian waters. A data base of selected federal and provincial geochemical surveys of soils in Canada has been prepared for Health Canada.

Legislated Environmental and Resource Assessments (GSC)

A Key Question Canadians Ask:

How do we ensure that natural-resource development does not harm the environment, and that appropriate land-use decisions are made?

At the request of federal government agencies responsible for specialized land-use designations (e.g. Parks Canada, Department of Fisheries and Oceans), and consistent with federal legislation and policy, the LERA program will provide resource assessments so that the mineral and energy resource potential is duly considered when establishing protected areas. These assessments will apply to lands under federal jurisdiction and under consideration as National Parks, Marine Protected Areas or other special designations that restrict mineral or energy development, including those in the Territories (Yukon, Northwest Territories, Nunavut) and Canada Lands offshore-shore.

In response to federal government agencies' requests and as required by the Canadian Environmental Assessment Act (CEAA), the program will also provide expert geoscience reviews of projects undergoing environmental assessment ensuring the identification, consideration and minimizing of adverse environmental impacts.

Budget for FY 2003/2004: $1.6 M

Actual expenditures FY 2003/2004: $0.4 M

Committed Outcomes

Informed federal government decisions on proposed land-use restrictions

Ministerial decisions on the environmental impact of projects are informed by geoscience expertise

Committed Outputs	Results Accomplished to Date
Published mineral and energy resource assessments of areas proposed for special land-use designation	Completed three resource-assessment studies in 2003/2004. The Mineral and Energy Resource assessment of initial select areas under consideration for expansion of the Nahanni National Park Reserve was released as GSC Open File 1686. The mineral resource assessments for two proposed Marine Protected Areas, the Gully (Scotian Shelf) and the Beaufort Sea, were published as GSC Open Files 1634 and 1820.
Formal geoscience contribution in all phases of the federal environmental assessment and review process	Provided expertise in the federal Environmental Assessment review process for more than 45 development projects in 2003/2004.

Natural Hazards and Emergency Response (GSC/GC)

A Key Question Canadians Ask:

What is being done to minimize risk due to natural hazards?

This program assists in the mitigation of natural hazards and is intended to reduce the loss of life and economic costs of all natural disasters in Canada.

To reduce losses from natural hazards, the program works with national and international partners and clients to produce: a modern robust analysis of seismic risk, suitable for developing a modern building code; effective forecasts of magnetic storms and mitigation strategies against damage to electrical grids, satellite communication and pipelines; and landslide, tsunami (tidal wave), flood- and volcano-hazard inventories and assessments, used to build effective response scenarios and disaster mitigation for populated centres at risk.

Emergency-response programs are enhanced by providing them with comprehensive digital and custom maps for emergencies, integrated hazard and infrastructure information, and the capacity to measure radiation contamination from accidental dispersal or potential terrorist acts.

Budget for FY 2003/2004: $9.6 M

Actual expenditures FY 2003/2004: $8.3 M

Committed Outcomes

Decreased losses from earthquakes, tsunamis, landslides, magnetic storms and volcanic eruptions

Enhanced disaster-response preparedness in population centres and critical infrastructure at highest risk

Committed Outputs	Results Accomplished to Date
Advanced earthquake monitoring and space weather services	An operational prototype dense urban seismic network has effectively recorded the distributed earthquake shaking in parts of Vancouver and Richmond, British Columbia, in order to characterize the detailed ground response to earthquakes. Two of the 13 geomagnetic observatory stations were converted to provide real-time data transmission. Geomagnetic Reference Field model was delivered to NAV CANADA that will improve magnetic compass navigation.
Detailed hazard assessments for 25 percent of the population that is at high risk	A study of the ancient flood record determined the flood recurrence history for the Red River Valley, and was used to design flood hazard mitigation for Winnipeg, Manitoba. An agreement has been reached whereby GSC will provide the geohazard mapping protocols for railway corridors, permitting various stakeholders to provide consistent mapping services. The province of Quebec used GSC information to prepare landslide-hazard, risk-management maps for 40 counties in the St. Lawrence lowlands in response to provincial legislation.
Models of landslide behaviour, suitable for risk assessment by 2004	Rockfall hazard models are ready for field-testing.
Custom emergency maps and images, in response to complex crisis events and emergencies (e.g., floods)	More than 3000 custom maps were supplied to crews fighting the 2003 British Columbia forest fires. Radioactivity detection equipment was tested with the Department of National Defence to develop response protocols and the equipment was tested. Custom maps and expertise were supplied for two emergency preparedness exercises: Topoff 2 in British Columbia and Roche Brisée II in Quebec.

Aeronautical Charting (GC)

A Key Question Canadians Ask:

Is it safe to fly in Canadian airspace?

The Aeronautical Charting Program is responsible for the production of Canada's official aeronautical information charts and publications for military and civil aviation institutions, in support of NAV CANADA and Department of National Defence operations.

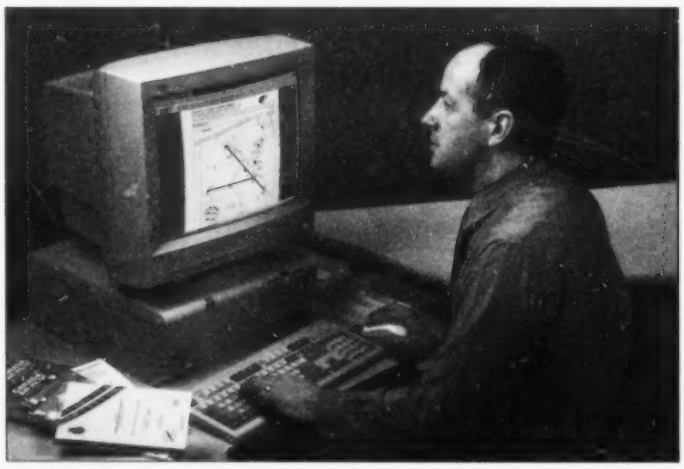
Budget for FY 2003/2004: $300 K A-base and $7.5 M Revolving Fund

Actual expenditures FY 2003/2004: $800 K A-base and $6.5 M Revolving Fund

Committed Outcome

Safety of the flying public and of every community over which air traffic flies

Committed Output	Result Accomplished to Date
Provision of aeronautical charts and publications for the safety and efficiency of civil and military air navigation in Canada	Delivered updated information to the 2003 Geomagnetism Epoch Model, the Enroute Chart, Canada Air Pilot, Visual Flight Rules, Canada Flight Supplement, Water Aerodrome Supplement, Designated Airspace Handbook, Canadian Aeronautical Charting database, Air Traffic Controller Charts, and planning and plotting charts products produced to clients' requirements.



Canada-United States International Boundary Maintenance and 1925 Treaty Implementation (GC)

A Key Question Canadians Ask:

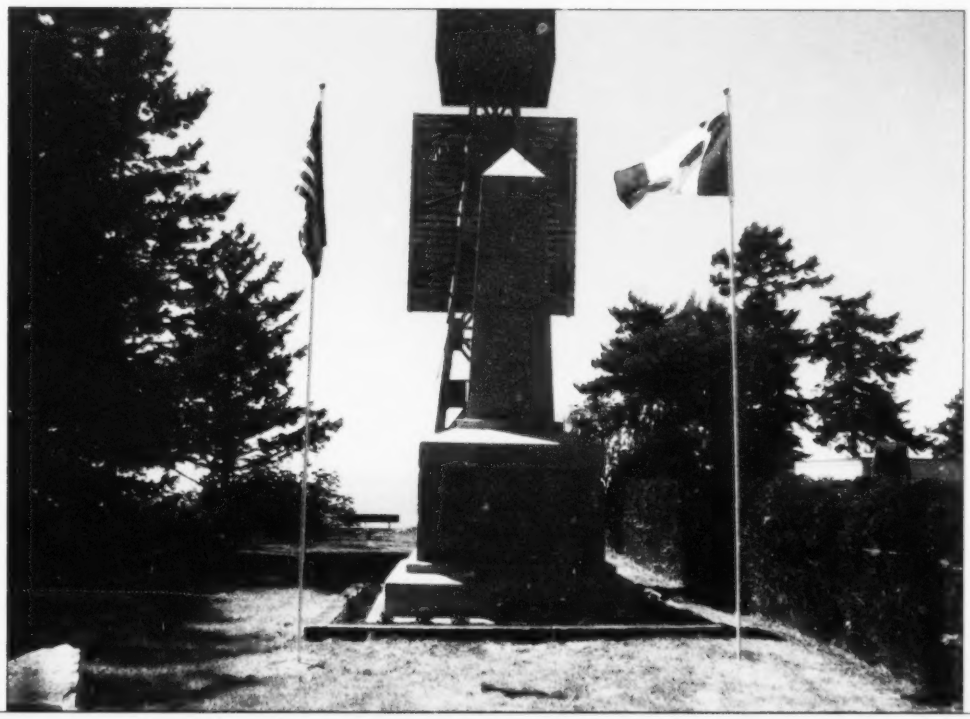
Do we have a well-defined and visible boundary that supports sovereignty and the effective enforcement of customs and immigration regulations, and national security?

Under the auspices of the International Boundary Commission, this partnership program with the United States of America serves to maintain the international boundary line and vista. Boundary maintenance involves inspection, monument restoration and maintenance, resurveying and vegetation clearing. These responsibilities, along with the regulation of activities within the vista, and providing advice to government on disputed areas, form the basis for a Joint Annual Report.

Increased border security measures require that boundary maintenance and clearing will concentrate in the most populated areas along the Quebec-New York, Vermont, New Hampshire and Maine boundaries, and along the British Columbia-Washington boundary.

Budget for FY 2003/2004: $830 K

Actual expenditures FY 2003/2004: $700 K



Committed Outcome

Progress towards an international boundary line that supports the effective enforcement of customs, immigration, national security and other laws in Canada and the United States of America, as defined by the treaties that govern the Commission's activities

Committed Outputs	Results Accomplished to Date
Annual boundary maintenance of not less than 150 km of boundary line and vista by the Canadian section of the International Boundary Commission	In total, 56 km of boundary vista were cleared and 195 km of boundary were inspected. As a result of inspections, 31 monuments were repaired/rebuilt, 131 monuments were refurbished, and one new monument was established.
A Joint Annual Report submitted to Canada's Minister of Foreign Affairs and the United States Secretary of State	Boundary maintenance activities, including the regulation of work within the vista, and the provision of advice to government on disputed areas, are incorporated into the Joint Annual Report.

Geomatics for Connecting Canadians (GC)

A Key Question Canadians Ask:

Can I easily access authoritative government geospatial information and state-of-the-art, innovative, on-line services to help me make informed decisions?

The Geomatics for Connecting Canadians program aims to make ESS geospatial information more accessible to clients on-line, in order to enable its wider use and, consequently, contribute to more informed decision-making. The program builds on the success of, and furthers ESS's contribution to, the Canadian Geospatial Data Infrastructure.

Budget for FY 2003/2004: $3.8 M

Actual expenditures FY 2003/2004: $6.0 M

Committed Outcomes

The Connecting Canadians program continually improves the on-line access to ESS geospatial products through common processes and tools

ESS is recognized by Canadians and by the world community, as a leader in providing on-line access to publishing of geospatial information products

Committed Outputs	Results Accomplished to Date
On-line access, processes and tools to key ESS geospatial information and products	The opening of the GeoBase portal has resulted in a five-fold increase in the amount of basic geospatial data accessed by clients. The Atlas of Canada made available on-line 943 archive maps representing Canada since 1906. Some 500 000 monthly visits are made to the program's Web applications by external clients, generating over 150 000 maps.
Harmonization of ESS information management, licensing and distribution policy	ESS geospatial data are made available through the GeoBase portal according to the common Unrestricted Use License Agreement. An analysis was completed of data-distribution mechanisms within the program, resulting in an updated plan for more efficient and effective delivery of data to clients.

Consolidating Canada's Geoscience Knowledge (GSC)

A Key Question Canadians Ask:

Are we maximizing government investments in geoscience through innovative partnering with all levels of government, industry and academia?

Canada's global attractiveness for investments in mineral and energy exploration and development, and the soundness of its own sustainable-development decisions, require a comprehensive geoscience knowledge base. This program contributes to establishing more efficient and effective discovery, access, delivery and management of Canada's geoscience data, information and knowledge. In addition, in developing an implementation plan for the Co-operative Geological Mapping Strategies, it is defining new partnerships with provincial and territorial agencies, industry and universities to jointly deliver geoscience knowledge as the basis for fact-based decision making.

Program delivery has been accelerated and expanded through additional funding for two years from Phase 2 of the Targeted Geoscience Initiative announced in the 2003 Government of Canada budget.

Budget for FY 2003/2004: $8.9 M

Actual expenditures FY 2003/2004: $12.3 M

Committed Outcomes

Increased Canadian competitiveness for attracting industrial investments in mineral and energy exploration and development sustained through timely knowledge transfers

ESS, provincial and territorial digital knowledge bases and catalogues interconnected and used by resource-development stakeholders, as a definitive source of geoscience knowledge

Committed Outputs	Results Accomplished to Date
National Geological Surveys Committee co-authored implementation plan to advance the Cooperative Geological Mapping Strategies	A series of Canada-wide consultations with all the provincial and territorial geoscience agencies has delivered a set of key reports that represent a synthesis of their geoscience gaps and other priorities. This is being merged with the results of GSC-wide consultations to account for respective priorities. These are leading to a national workshop in late spring 2004 that will develop the implementation plan.
On-line, interoperable access to key ESS geoscience information for resource exploration, and in conformity with Government On-Line and Canadian Geospatial Data Infrastructure requirements	A suite of five Geoscience Data Repository Projects has been initiated and they are building the common Web interfaces to ESS resource geoscience data bases. On-line access to select ESS geophysical and geochemical, bedrock, paleontological, surficial and geochronological data holdings is now possible, with more data available over the next several months.

Geoscience for Oceans Management (GSC)

A Key Question Canadians Ask:

Are we protecting and managing our oceans properly?

This program contributes to the geoscience knowledge that is required to inform decision-making in Canada's offshore lands so that land-use, including offshore structures and resource-development decisions, balance social, economic and environmental considerations. Underpinning this program is a systematic approach to sea-floor mapping to deliver geoscience knowledge for integrated ocean management. The legislative and strategic framework for this program is found in the Canada Oceans Act and Canada's Oceans Strategy.

The program focuses on priority areas with multiple sea-floor-use issues, or where large-scale projects require extensive multi-disciplinary knowledge. Projects address four themes: integrated management of large ocean areas; assessment of hazard potential and environmental impact of infrastructure; understanding geological controls on ocean-floor habitat distribution; and assessment of human impact on marine environmental quality in the coastal waters of Eastern Canada.

Budget for FY 2003/2004: $6.7 M

Actual expenditures FY 2003/2004: $6.3 M

Committed Outcomes

- Ouputs used to minimize environmental impact of sea-floor infrastructure and for the resolution of conflicts regarding sea-floor use
- Ocean-management decisions will balance competing demands of renewable and non-renewable resources with conservation

Committed Outputs	Results Accomplished to Date
All sea-floor geoscience data accessible digitally, with 25 percent of the data incorporated in revised digital map products	Completed data base development making surficial geoscience data publicly available. Geoscience for Oceans Management data availability to the public has been instrumental in the early planning phases of significant developments of strategic importance in Canada's offshore lands. Examples include the establishment of new Marine Protected Areas; consideration for a new gas pipeline from Grand Banks to Newfoundland; determining the routing of a proposed offshore pipeline to Boston; reviewing potential lifting of the moratorium on hydrocarbon exploration in offshore B.C.; and determining the validity of offshore utility corridors in Nova Scotia. Incorporated 25 percent of geoscience data in revised map products. New mapping standards for GSC marine products have been established.
National sea-floor mapping strategy developed with federal partners	Mapping strategy was developed to define common methods, standards and output requirements for all seabed-mapping activities.

Sustainable Development Through Knowledge Integration (GSC/GC)

A Key Question Canadians Ask:

Do we have the knowledge and tools to effectively integrate data to support informed decision-making regarding the sustainability of our resources?

This program helps to ensure that S&T research data, information and knowledge are effectively integrated, so as to support informed decision-making regarding Canada's progress in sustainable development. In particular, the program is developing methodologies and tools that forecast the impacts of energy consumption, energy loss and mine tailings on sustainable-development indicators. Policy and decision-makers will then have access to geoscience and geomatics data, information and knowledge in a multidisciplinary decision-making context.

Budget for FY 2003/2004: $4.3 M

Actual expenditures FY 2003/2004: $3.0 M

Committed Outcomes

Overcoming technological barriers to the regular use of integrated Earth science information by NRCan to demonstrate progress in achieving Sustainable Development

NRCan use of advanced data models and data integration methods are used to report to stakeholders on how the NRCan Sustainable Development Strategy advances sustainable development

Committed Outputs	Results Accomplished to Date
Advanced Decision Support Systems through forecast scenarios of key elements (including energy consumption, energy loss and mine tailings) and projections about their relationship to, and impact on, sustainable development	Identification of land-use indicators for the Energy Sector has been achieved using remotely sensed information. The Energy Sector, Canadian Forest Service, Environment Canada and Statistics Canada have provided verification. A new design of the Canadian Wild Fire Information System for decision support has been completed, along with data integration of key information during the fire season. The B.C. Forest Protection office received this innovative system. Fundamental processes to model urban growth, as well as possible impacts of natural hazards in the Vancouver area, are complete. User needs have been defined, data acquisition completed and discussions with GeoConnections and the provinces for access to information about abandoned and orphaned mines have been completed, and will lead to the longer term development of a monitoring system for Canada.
A data model describing the structure and architecture required of selected geoscience information holdings to facilitate unanticipated knowledge integration requirements as driven by the NRCan Sustainable Development Strategy reporting goals	Standardized approaches for information extraction are currently being developed and tested; examples are in assessments of forest disturbances and in urban assessment. These activities engage various partners such as the Energy Sector, Canadian Forest Service, Environment Canada and Canadian Space Agency. A data model environment is being explored for archiving, processing, modelling and information delivery for this program.
Innovative data-integration methods that advance selected aspects of ESS capacity to support NRCan to report against progress in the SD Strategy	Methods for integration of geoscience information for visualization of sustainable development parameters, including low-resolution temporal assessment of forest conditions, were implemented to trigger multi-resolution information integration and mapping.

Geomatics for Sustainable Development of Natural Resources (GC)

A Key Question Canadians Ask:

What information is available to support the sustainable development of natural resources?

Responsible natural-resource management requires geospatial data and information to support actions and decisions. The Geomatics for Sustainable Development of Natural Resources (GSDNR) Program provides consistent, reliable, high-quality, accurate geospatial information to ensure that clients and stakeholders have the capacity to make responsible decisions. Consistent improvements are being made to the reliability and use of this information by incorporating new sources of data, where applicable, and moving towards integration with other reference sources within NRCan.

Budget for FY 2003/2004: $9.6 M

Actual expenditures FY 2003/2004: $10.5 M

Committed Outcomes

ESS leadership in, and contribution to, the creation and maintenance of a national framework of digital geospatial data, acknowledged by the natural resources community as being essential to support sustainable-development decisions

More efficient and effective decision-making by communities, industry and sustainable-development policy organizations involved in Canada's sustainable development of natural resources

Committed Outputs	Results Accomplished to Date
Basic geospatial information layers (produced according to national data standards achieved through partnerships with various provincial data producers), including: geographic names; national thematic frameworks, elevation data, hydrography, transportation networks, support to the cadastral surveys (parks and offshore), and satellite ortho-imagery	The 1:1M National Scale Framework Hydrology-Drainage Areas data set is an output from the National Integrated Thematic Frameworks Project. Environment Canada has confirmed that this data set will form the base for a national Watershed Lookup Service. Statistics Canada, and Agriculture and Agri-Food Canada's National Agri-Environmental Health Analysis and Reporting Program are completing evaluation of the 1:1M Watershed Framework as a geographic standard to identify sustainable-development indicators for reporting on the interaction of agriculture and the environment for soil, air, water quality, biodiversity and eco-efficiency.
Basic geospatial information layers (produced according to national data standards achieved through partnerships with various provincial data producers), including: geographic names, national thematic frameworks, elevation data, hydrography, transportation networks, support to the cadastral surveys (parks and offshore), and satellite ortho-imagery	Statistics Canada, Elections Canada and the Canada Post Corporation use GSDNR's National Road Network model as a framework to which geographic features can be linked and displayed. The use of a common core road-network model will ensure uniformity and cost efficiency in producing, maintaining and sharing digital road data. The provision of digital elevation-model data to industry to evaluate the hydro-electric potential and environmental acceptability for resource development. In collaboration with Environment Canada, a pilot study using the National Hydrographic Network has been undertaken. A partnership involving several departments from the federal and Nova Scotian governments was established to produce a hydrographic model for the Pockwock Lake watershed, a drainage basin that supplies water to the Halifax Regional Municipality.
Continuous communication and outreach strategy and activities to improve awareness, use and access to geospatial information, in support of the sustainable development of natural resources	The GSDNR program launched its Web site on February 3, 2004 (http://gsdnr.nrcan.gc.ca/). Client feedback has been positive, including a commitment from Forest Research Extension Partnership (FORREX) in British Columbia to publish an article on GSDNR to inform its members. FORREX represents natural resources agencies, provincial government, Crown corporations, industry, communities, First Nations and academia in B.C. GSDNR delivered geo-referenced Landsat-7 satellite-imagery coverage of Canada to the Canadian Forest Service, in support of its contribution to Kyoto reporting through the National Forest Carbon Accounting Program (NFCAP). The NFCAP includes the new National Forestry Inventory, one of six indicators identified by the National Round Table on the Environment and Economy to track the impact of economic practices on Canada's natural and human assets.

Gas Hydrates – Fuel of the Future? (GSC)

A Key Question Canadians Ask:

Will we have sufficient and reasonably priced energy to meet our future needs?

This program contributes to the development of gas hydrates as an unconventional energy source, in order to ensure a secure energy supply. It will identify the scientific and technological knowledge required for the sustainable development of this resource for all areas in Canada that host large gas hydrate deposits, mainly in the high Arctic and in offshore areas, at water depths greater than 800 metres.

Three key projects are gas hydrate properties and reservoir behaviour, terrestrial occurrences and marine occurrences. The outputs of these projects will allow for detailed characterization of gas hydrate properties for pilot production tests, potentially in the Mackenzie Delta.

Two strategies are being followed. One will focus on leveraged industrial collaboration and the maintenance of a globally acknowledged and highly motivated scientific team; and the other, on the development of a gas hydrate policy roadmap, in collaboration with other sectors in NRCan and industry.

Budget for FY 2003/2004: $1.9 M

Actual expenditures FY 2003/2004: $1.9 M

Committed Outcomes

Recognition of gas hydrates as a potentially significant and environmentally friendly energy source

Canadian industry engaged in assessment potential of gas hydrates as a resource

Committed Outputs	Results Accomplished to Date
Volumetric gas hydrate assessments on Canada's Atlantic and Pacific oceanic margins and the Mackenzie Delta region	The results of research on gas hydrates of the Atlantic margin were completed and published. Progress was made on both the characterization and assessment of Mackenzie Delta–Beaufort Sea gas hydrates and the mapping of bottom-simulating reflectors in petroleum industry marine seismic records. The Mackenzie Delta–Beaufort Sea gas hydrate assessment is being prepared in cooperation and collaboration with the Energy Sector's Program of Energy Research and Development.
Characteristics of Canadian gas hydrate occurrences and their resource potential and development risks	The Mallik 2002 Research Well Consortium Partners and the Technical Research Centre of the Japan National Oil Corporation sponsored the "From Mallik to the Future" International Gas Hydrate Research Symposium in Makuhari, Japan, December 7–10, 2003. The conference was held to report the scientific and engineering breakthroughs of the Mallik 2002 gas hydrate research well drilled in Canada's Mackenzie Delta, NWT.
Contribution to a policy roadmap to stimulate private-sector development of gas hydrates	In cooperation with from the Energy Sector, other government agencies, industry and academia, ESS developed a Roadmap for Gas Hydrate Development in NRCan. A draft strategic plan is now in place. The Canadian Workshop on Natural Gas Hydrates was held in March at the Geological Survey of Canada office in Sidney, British Columbia.

Targeted Geoscience Initiative (GSC)

A Key Question Canadians Ask:

Will Canada continue to attract investment in the increasingly competitive global exploration and development market?

The Government of Canada committed $10 M over two years to extend the mission of the original three-year Targeted Geoscience Initiative Program with a renewed focus on the energy sector, including energy-oriented activities in Canada's North. The Targeted Geoscience Initiative provides integrated geoscience knowledge pertaining to areas of high energy and mineral potential, with the intent of stimulating private-sector resource exploration. TGI is, by definition, a partnership program, delivered in collaboration with provincial and territorial geological surveys with participation by industry and universities. TGI outputs and outcomes for fiscal years 2003/2004 and 2004/2005 are delivered through projects that are part of both the Northern Resources Development (NRD) and Consolidating Canada's Geoscience Knowledge (CCGK) programs.

Budget for FY2003/2004: $1.2 M

Actual expenditures FY 2003/2004: $1.4 M

Committed Outcomes

Digital, Web-enabled geoscience data contributes to Earth-science investment decisions in the North

Northern investment in exploration, development and resource extraction increases significantly from 2002/2003 levels

Increased Canadian competitiveness for attracting industrial investments in energy and mineral exploration and development sustained through timely knowledge transfers

Committed Outputs	Results Accomplished to Date
New multi-thematic regional geoscience analyses and syntheses for northern areas with resource potential	New 3-dimensional models of the stratigraphy of the Mackenzie Valley corridor, the Mackenzie Delta/ Beaufort Sea, Bowser Basin, and the offshore of northern Labrador and Lancaster Sound are under construction; these models are facilitating analysis of the thermal history and characteristics of the petroleum systems of these areas. This new information will enable new exploration for hydrocarbons in these highly prospective areas of Canada's North.
10 percent of existing northern data converted into GIS and Web-enabled formats	Conversion of bedrock and surficial geology data are being converted to modern GIS standards, a prototype method to migrate these data to the Internet has been built and is being tested.
Predictive models for hydrocarbons of prospective northern basins and all known mineral deposit types over 15 percent of the North	Ongoing work in frontier petroleum basins, supplemented by TGI-2, in the intermontane of northern British Columbia, Mackenzie Delta, Mackenzie Corridor and northwestern Alberta has produced preliminary hydrocarbon potential models for approximately 5 percent of the area. During year one of these projects, most work focused on compiling and synthesizing all available geoscience data.
Syntheses, analyses and watching briefs on key areas for resource exploration and related sustainable development relevance, such as in the Western Canada Sedimentary Basin, Atlantic and Eastern Canada	Cooperative projects have been established with Manitoba, Saskatchewan, Ontario, Quebec, New Brunswick, Nova Scotia, and Newfoundland and Labrador. These projects are now delivering information on key geologic risks to successful hydrocarbon exploration in the Williston Basin and Appalachian regions. In Saskatchewan, a joint project with that province is defining the geometrics of diamondiferous kimberlite bodies, as an aid to exploration.

Northern Resource Development (GSC)

A Key Question Canadians Ask:

How can northern communities attain economic self-sufficiency and social stability?

Future economic sustainability and quality of life for northern Canadians, most of whom are First Nations or Inuit, depends on the responsible development of mineral and energy resources. In partnership with the provincial and territorial geological surveys and other federal departments, this program delivers an improved, expanded geoscience knowledge base to stimulate new private-sector investment in mineral and energy development to create additional opportunities for northerners. The program also supports northern capacity building, in terms of increased understanding of geoscience for decision-making and increased employment opportunities provided by exploration companies.

Program delivery has been accelerated and expanded through additional funding from a two-year extension of the Targeted Geoscience Initiative, as announced in the 2003 federal budget.

Budget for FY 2003/2004: $11.1 M

Actual expenditures FY 2003/2004: $14.0 M

Committed Outcomes

A 50 percent increase in investment in northern resource exploration and development over 2002/2003 levels

A five percent increase in the number of northern communities using geoscience information in planning and decision-making for resource development and land-use plans

Increased number of northern students enrolled in geoscience programs

Committed Outputs	Results Accomplished to Date
Regional digital geoscience map compilations over 10 percent of the northern territories, integrating geophysical and remotely sensed data	Significant progress has been made in the Western Churchill province, central Nunavut, where compilation of remotely sensed, geophysical and archival geoscience data has allowed improved interpretation of the regional geology, resulting in the identification of highly prospective areas for precious and base metals. Similar compilations are underway in the Trans-Hudson Orogen and Slave province projects.
Predictive models for hydrocarbons in prospective northern basins and all known mineral deposit types over 15 percent of the North	Ongoing work in frontier petroleum basins, supplemented by TGI-2, in the intermontane of northern British Columbia, Mackenzie Delta, Mackenzie Corridor and northwestern Alberta has produced preliminary hydrocarbon potential models for approximately 5 percent of the area. During year one of these projects, most work focused on compiling and synthesizing all available geoscience data.
Digital mineral potential maps for 25 percent of the North	Production of mineral potential maps has been delayed. In partnership with the Alberta Geological Survey, Northern Resource Development (NRD) staff released a CD-ROM which included maps and data pertaining to the potential for kimberlite-hosted diamond deposits, gold and base metals in the southern Buffalo Head Hills area of Alberta.
10 percent of northern communities visited with geoscience resource educational programs	NRD scientists have made key links with local First Nations in northern B.C. and northwestern Alberta through geomorphic and cultural connections. A member of the Dene Tha' band council in Chateh, Alberta, accompanied NRD scientists in the field to promote interaction between NRCan and the Dene Tha' people. Community outreach in British Columbia is generating positive feedback with educators, science centres and First Nations. Scientists from NRCan are partnered with staff of The Exploration Place Science Centre in Prince George, and with teachers from communities in northern British Columbia.

Geomatics for Northern Development (GC)

A Key Question Canadians Ask:

Do northern governments and communities have appropriate access to reference systems and modern technology for managing their lands?

The Geomatics for Northern Development program provides reliable and consistent geospatial information and well-defined property rights, by providing assistance to develop geospatial data to support capacity in northern governments and communities. This program supports new investment and sustainable development in the North. The outcomes of the program will lead to a broadly adapted suite of geospatial information recognized as critical to decision-making.

Budget for FY 2003/2004: $7.6 M

Actual expenditures FY 2003/2004: $7.4 M

Committed Outcomes

Better quality and efficiency in land-based decision-making regarding natural-resource and environment management by northern communities, leading organisations and governments

Increased and diversified investment by private companies in development of natural resources, tourism and local land-based development

Peaceful and unimpeded local land-based economic development by owners, land managers and developers

Committed Outputs	Results Accomplished to Date
Developing advanced techniques and methodologies for improved portrayal and integration of a full range of geospatial information datasets, including base geospatial information, accessible in an environment adapted to northern requirements	Production target for FY 2003/2004 was 1000 digital topographic data sets. At year-end, 280 of 300 have been completed for Nunavut and 719 of 700 Northwest Territories. This brings the total available coverage for Nunavut to 1474 data sets, out of total coverage of 2518 or 59 percent of the data sets available for the territory. This brings the total available coverage for the Northwest Territories to 1519 data sets, out of total coverage of 1992 or 76 percent of the data sets available for the terr ory.
Working within a GC-coordinated strategy and program plan for northern development based on client and stakeholder consultations	New data sets created include the development of Precise Point Positioning, the completion of the Ungava Bay Gravity Survey, completion of maps in the Mackenzie Valley and a geological terrain mapping project in Northern Ontario.

Geomatics for Aboriginal Property Rights Infrastructure (GC)

A Key Question Canadians Ask:

What property rights information is required to support Aboriginal management of their land and other resources?

Building Aboriginal peoples' capacity for economic and social development requires effective and culturally aligned, land-administration systems that support a robust, reliable and flexible property rights infrastructure. The Geomatics for Aboriginal Property Rights Infrastructure program is structured around support for the Comprehensive Land Claims in the North and British Columbia and support for key Aboriginal governance programs, including those flowing from the First Nations Land Management Act (FNLMA), Treaty Land Entitlement programs, Indian and Northern Affairs Canada's (INAC) Lands and Trusts Services program, Cadastral Operations on Aboriginal Lands (South) and Capacity Building-Cadastral Reform.

Budget for FY 2003/2004: $10.1 M

Actual expenditures FY 2003/2004: $9.2 M

Committed Outcomes

Increased effectiveness and self-sufficiency of Aboriginal land and resource management, investment in land and economic development, and social and environmental benefits

Sustainable community development and stimulation of local economies through capacity-building, and jobs as a result of legislated implementation activities

Committed Outputs	Results Accomplished to Date
Management of surveys and mapping contracts to support the legal boundary definition of settlement lands and the preparation of appropriate legal descriptions and the provision of advice and consultation to stakeholders	In the Yukon Territory, the Northwest Territories and Nunavut, the program has successfully managed the legal land surveys required for the proper definition of 3 key comprehensive land-claim settlements. The creation of a reliable and flexible property rights infrastructure for these Aboriginal and Inuit groups is a significant step in support of self-reliance and the economic sustainability and cultural development of their communities.
Management of INAC's annual survey projects, including those required for lands and trusts, devolution, treaty land entitlement and additions to reserves	Through ESS's regional presence, INAC's surveys and mapping program on First Nations' lands has been successfully managed. This activity contributes to, and supports, the economic and social success of First Nation communities. This year, the program managed $4 M of INAC funding for surveys and mapping.
Research and preparation of land descriptions for administrative land transfers between governments, the provision of professional opinions on specific claims and other litigation, and the development and production of specialized geomatics products in support of effective lands administration	ESS supports Canada's commitment to promoting self-reliance and the socio-economic aspirations of First Nation communities through the First Nations Lands Management Initiative. Numerous land descriptions and support documents have been prepared to assist First Nations seeking self-governance under the First Nations Lands Management Act.
Training, technical assistance and knowledge was delivered to foreign partners for capacity and institutional building	The Capacity Building–Cadastral Reform project is partnered with INAC's Indian Lands Registry (ILR). This project integrated the business processes and information systems of the ILR and the Canada Lands Surveys System. The results support self-reliance and promote a reliable and flexible property rights infrastructure on all Canada Lands.

A Key Question Canadians Ask:

Can Canadian geomatics and geoscience projects improve lives in developing nations?

Global Opportunities Program (GSC/GC)

In order to contribute to Canada's foreign-policy objectives, this program supports the creation of opportunities through the Earth sciences in developing countries, and helps open foreign markets to Canadian geoscience and geomatics companies. These goals are being achieved through participation in externally funded international development projects in which the various Earth sciences can make a significant contribution to the sustainable developmental of natural resources.

Budget for FY 2003/2004: $228 K

Actual expenditures FY 2003/2004: $200 K

Committed Outcomes

Developing nations have increased capacity for using Earth science knowledge in sustainable development decisions and hazards mitigation strategies

Canadian universities and geoscience and geomatics companies leverage ESS projects to develop international opportunities

Committed Outputs	Results Accomplished to Date
Partnership accords signed with foreign Earth-science institutions	Negotiations are underway for a collaborative agreement with the Chinese National Oil and Gas Development Company for a proposed project for coal-bed methane and heavy-oil collaborative research with China.
Spin-off contracts for Canadian geospatial and geomatics companies consequent to participation in the program	As a result of its work on an implementation contract for the Northeast Brazil Groundwater project, a Canadian company has been successful in licensing their hydrogeologic database management system, both nationally and internationally. A Canadian contractor for the national Tunisian mapping agency project won two spin-off contracts with the Government of Tunisia.
Training, technical assistance and knowledge was delivered to foreign partners for capacity and institutional building	The MAP–GAC project held two workshops in Santiago (Chile) and Mendoza (Argentina). Representatives of the seven Andean countries that participated in the project attended the workshops covering risk assessment and mitigation of natural hazards. A training session in geospatial data infrastructure was given to Tunisian government professionals.

Climate Change Impacts and Adaptation

The objective of the Climate Change Impacts and Adaptation Program is to improve knowledge of Canada's vulnerability to climate change, to better assess the risks and benefits posed by a changing climate, and to build the foundation upon which appropriate decisions on adaptation can be made. The program supports research to fill critical gaps that limit knowledge of vulnerability; to undertake and support assessment of impacts and adaptation; to enhance collaboration between stakeholders and researchers; and to facilitate policy development. The knowledge generated in the program will feed into policy via the participation of decision-makers in the program elements, and through reports. Key activities include:

- A five-year program providing funding on a competitive basis to Canadian researchers to address gaps in knowledge of Canada's vulnerability to climate change, and to provide information for adaptation decision-making.
- The Canadian Climate Impacts and Adaptation Research Network (C-CIARN), created in 2000, provides voice and visibility for climate-change impacts and adaptation issues, and fosters research collaboration between scientists and stakeholders.
- Leading the national assessment of Canada's vulnerabilities to climate change that will be delivered in 2006.
- Serving as the federal lead, in collaboration with the provinces and territories, for development of the National Adaptation Framework.

Budget for FY 2003/2004: $5.8 M

Actual expenditures FY 2003/2004: $6.8 M

Committed Outcomes

- Raised awareness of the impacts of climate change on Canada and the roles of adaptation in addressing them
- Increased capacity to undertake research related to impacts and adaptation
- Greater stakeholder engagement in impact and adaptation research
- Improved coordination and collaboration between research and stakeholder communities
- Adaptation strategies become developed and implemented, reducing the negative impacts of climate change and enhancing its benefits

Committed Outputs	Results Accomplished to Date
Research reports that address the gaps in knowledge about Canada's vulnerability to climate change	The funding of 80 projects addressing gaps in knowledge in areas such as water resources, food supply and transportation, to name a few. Eight water-resources projects delivered reports which included an examination of climate change for Canada's boundary and transboundary water management; groundwater resource sustainability in British Columbia; and hydroelectricity in Newfoundland and Labrador.
Plain-language summaries of impacts and adaptation issues in Canada	The report *Climate Change Impacts and Adaptation: A Canadian Perspective* provides a summary of the implications of a changing climate for key sectors in Canada based on published work in the past five years. It is available on the CCIAP Web site (adaptation.nrcan.gc.ca) and has also been distributed in CD format at key meetings.
Data and results available via Web access	88 projects were added to the projects database, accessible through the CCIAP Web site. Listings include summaries of geographic information, contact information for the project leader, and links to final reports for those projects that have been completed.
A national workshop on issues of regional and sectoral importance, including identification of knowledge gaps and research priorities	Planning is underway for the national workshop to take place in 2004/2005. Targeted workshops were held to examine approaches to measuring adaptive capacity, increasing economic research in this field and the process of science assessment – all building towards the national workshop.
Trained researchers in impacts and adaptation tools and methods	C-CIARN held 20 regional and sectoral workshops across the country, building awareness of new research approaches. They also sponsored two sessions that trained researchers in the use of climate scenarios.

GeoConnections

This program delivers consolidated geospatial information to Canadians to foster knowledge about Canada, to enable better policy and business decisions, and to advance Canada as a world-class leader in developing and using innovative on-line content and services.

GeoConnections is a national partnership initiative led by NRCan in which governments, the private sector, academia and non-government organizations are partnering to develop the Canadian Geospatial Data Infrastructure. This new infrastructure will make geographic data and information, visualization tools and data-discovery services interoperable and easily accessible on the Internet.

Budget for FY 2003/2004: $15.8 M

Actual expenditures FY 2003/2004: $12.5 M

Committed Outcomes

Canadians from varying fields of expertise have better access to quality geospatial data and tools, helping them make better decisions

Increased efficiency and effectiveness of governments, including the provision of lower cost services, and increased response to needs of the public and private sectors

Increased empowerment for 100 rural, remote and Aboriginal communities to plan and make decisions towards a sustainable future, through the use of modern geomatics techniques

Canada's position as an international leader in the development of spatial data infrastructure is maintained, through innovative development of world-class geomatics technologies

Reduced policy barriers by developing and influencing adoption of common data licensing to expand and simplify access to, and use of, geomatics information

A stronger geomatics community fostered through effective partnerships and shared leadership

Committed Outputs	Results Accomplished to Date
Best practices guides on data licensing and implementation of Canadian Geospatial Data Infrastructure (CGDI) standards and specifications	The GeoConnections Policy Advisory Node published the first draft of *The Dissemination of Government Geographic Data in Canada: Guide to Best Practices*, which sets out a framework for end-user and distributor licenses. The Inter-Agency Committee on Geomatics endorsed standards and specifications previously endorsed by the CGDI. These will be implemented in Inter-Agency Committee on Geomatics partner departments.
Common Internet window access – providing citizens, industry, communities and government agencies access to geographic content, technology, services and expertise	Through the GeoConnections Discovery portal, over 1900 geospatial products and organizations are now accessible, in addition to 81 on-line Web services accessed by over 2000 users daily. GeoConnections contribution to the Atlas of Canada provides 438 interactive map layers and supports 320 000 visits by external clients each month.
A standards-based, interconnected network of data, tools, policies and client applications that form an infrastructure	Nurturing innovation of CGDI tools continues with applications developed for various communities of practice and through collaboration between experts via the CGDI. It is being used by Fisheries and Oceans, Natural Resources Canada, Environment Canada, Office of Critical Infrastructure Protection and Emergency Preparedness, National Defence, Parks Canada, Canadian Space Agency and Health Canada partners. A Request for Proposal has been launched for an updated CGDI Technology Vision and Implementation Plan. Support for industrial participation at the OpenGIS Consortium (OGC, an interoperable geoprocessing standards organization) continues through active participation on the OGC Board, cross-border technology pilots and cost-shared development of compliant technology by Canadian firms.
Agreements with stakeholders on data sharing, policies, and technology and application development	The GeoBase portal, which includes six layers of nationally integrated information, was launched in November 2003 and provides access to up-to-date, maintained, and 'closest-to-the-source' base geospatial data at no cost to users. Agreements to develop new communities of practice have been signed with Environment Canada, Health Canada and Public Works and Government Services Canada. The Sustainable Communities Initiative has helped communities fulfill their vision for a sustainable future and enhanced local governance by developing 32 new projects in 2003/2004 – bringing the total number of projects up to 109 for the last 4 years.

Polar Continental Shelf Project (PCSP)

As a national service delivery agency, the Polar Continental Shelf Project (PCSP) coordinates logistics support for Canadian government agencies, northern land claims, northern communities, and independent and university groups. On a full cost-recovery basis, it supports private-sector and non-Canadian groups that conduct scientific research in the Canadian Arctic. Researchers receiving logistics support from PCSP have helped to define Canada's offshore limits; establish Canada's claims to offshore hydrocarbon and mineral resources; identify safe shipping routes into northern communities; establish National Wildlife Areas and Migratory Bird Sanctuaries to protect and conserve wildlife habitats; identify pollution sources and their effects on the northern food chain; and to preserve and record the traditional knowledge of the North's Aboriginal inhabitants.

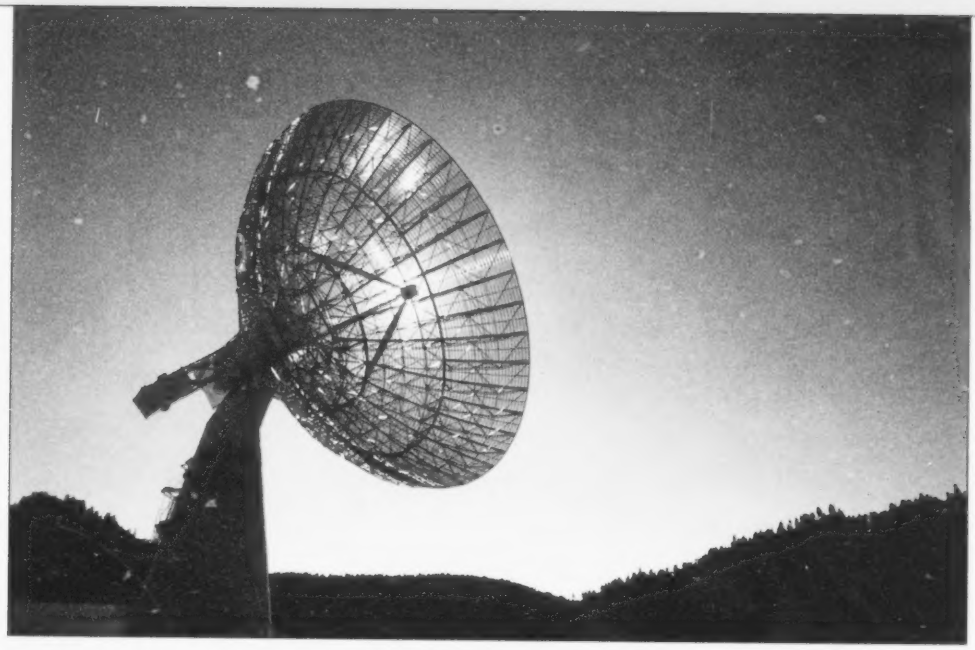
Budget for FY 2003/2004: $6.4 M

Actual expenditures FY 2003/2004: $7.3 M

Committed Outcome

> Logistics support to research contributes to government economic, environmental and social policies and priorities, including job creation in northern communities and sound decision-making.

Committed Output	Results Accomplished to Date
Provide coordinated, cost-effective logistics support to research programs in the Canadian Arctic in support of government social, economic and environmental priorities	Coordinated, cost-effective logistics support to 130 research programs throughout the Canadian Arctic. $2.0 million in support to the northern economy through contracting of services and supply purchases from northern Aboriginal companies and suppliers.



Earth Observation Data Services

The ESS Earth Observation Data Services (EODS) provides satellite data to NRCan programs and other governments of Canada in order to deliver on their outputs and outcomes. EODS provides data reception through two receiving stations, one in Prince Albert, Saskatchewan, and the other in Gatineau, Quebec. Also included in the service are state-of-the-art archiving, processing and data dissemination systems. The Satellite Acquisition Services group in Ottawa provides the client interface for services to programs.

EODS provides data-reception coverage for North America. The ground stations receive data from several satellite sensors and maintain the National Earth Observation archives dating back to 1972. Data are made available to support near-real-time applications, such as forest-fire monitoring and mapping, natural hazards and ice monitoring; as well as non-real-time applications, such as sustainable development, including land use management and climate change.

Budget for FY 2003/2004: $3.4 M

Actual expenditures FY 2003/2004: $4.1 M

Committed Outcomes

Involvement of the private sector in providing services and technology, thereby creating global opportunities for the Canadian geomatics companies

Influence and recognition of ESS Earth Observation capabilities at the international level, enhancing Canada's ability to leverage and participate in global advances, expertise and programs in support of Canadian needs

Committed Outputs	Results Accomplished to Date
Earth Observation data in support of Sector programs, including: Geomatics for Sustainable Development of Natural Resources, Geomatics for Northern Development, Reducing Canada's Vulnerability to Climate Change, Sustainable Development through Knowledge Integration, Natural Hazards and Emergency Response, and Groundwater	Satisfied ESS program requirements for Earth Observation data. There was a 14 percent utilization of Landsat data, primarily by Geomatics for Sustainable Development and Canada Centre for Remote Sensing distributors. Advanced Very High Resolution Radiometer data was 100 percent utilized by the Climate Change program. 99.89 percent success rate in the reception of over 5700 satellite passes. A Landsat-7 contingency plan was successfully implemented, resulting in the re-activation of Landsat-7 data reception and mitigating disruption to programs caused by degradation in Landsat-7 performance. A new agreement was concluded with the European Space Agency (ESA) for the provision of ERS-2 reception services for 2004. A RADARSAT-1 contingency plan using ENVISAT data was proposed, approved and funded by the Canadian Space Agency (CSA). This will ensure the continuity of Synthetic Aperture Radar (SAR) data to users if RADARSAT-1 becomes unavailable. Development of a Quality Management System based on ISO 9001:2000 continued to make good progress. Operational certification is expected in June 2004. A strategic review of the Canadian Earth Observation ground segment infrastructure requirements for the future was started. A CCRS/Canadian Space Agency-led steering committee with representatives from government, industry and others was established, and meetings were held January 9 and February 19, 2004.
Maintenance of, and access to, the historical Earth Observation data archives	Over 10 800 scenes archived. Over 5300 scenes extracted from archive
Generation and delivery of metadata to GeoConnections to host the Earth Observation Data Catalogue	Metadata for over 10 800 scenes provided to the Catalogue.
Development of the RADARSAT-2 Ground Segment for the Canadian Space Agency	The RADARSAT-2 ground segment development is proceeding on schedule.

Canadian Geodetic Service

The Canadian Geodetic Service maintains the Canadian Spatial Reference System (CSRS) as a national standard for geospatial and Earth-sciences information. The associated frame of reference for latitude, longitude, height and gravity, serves as the foundation for spatially referenced information systems and related geoscience needs. Applications range from land surveys to mineral exploration, navigation and mapping, to the use of remote-sensing data for resource management; from the construction of infrastructure and development projects, to the interpretation of seismic disturbances. The maintenance of CSRS involves monitoring the Earth's systems and determining related time-varying parameters that are implicated in global and climate change, meteorology and space sciences. This, in turn, requires highly leveraged scientific and technological efforts on an international level and coordination at the national, provincial and territorial levels.

Budget for FY 2003/2004 $4.1M

Actual expenditures FY 2003/2004: $5.1 M

Committed Outcomes

National consistency and global compatibility of coordinates in geo-referenced applications and data, enabling their seamless integration and interoperability

Enhanced efficiency and effectiveness of space-based positioning technology applied to surveying, mapping, navigation and land/resources management sectors

Committed Outputs	Results Accomplished to Date
The definition and maintenance, through international collaboration, of the International Terrestrial Reference Frame and Earth Orientation Parameters (i.e., Earth's coordinate axes system and its orientation in space)	Analysed data published throughout the year by the International Earth Rotation and Reference System service included weekly 24-to-48-hour quasar observing sessions carried out by the Algonquin Park Radio-Observatory, in conjunction with other global observatories. This is critical for geodetic reference systems, satellite orbit determination, geophysical and atmospheric research, and space navigation.
The maintenance of the national frame of reference for coordinates (i.e., the NAD83 coordinate reference system attached to the North American tectonic plate)	Real-time and daily data generated from round-the-clock observations at 43 GPS tracking stations provided the primary reference for coordinate determination in Canada. Analysis of key Canadian sites with globally distributed sites ensured global compatibility of the national spatial reference. The geoid model of mean sea level advanced through analysis of latest local and global gravity coverage. Gravity standards were maintained through scheduled network re-observation.

Canada Lands Survey System

In the role of corporate surveyor for the federal government, the Surveyor General of Canada protects the interests of the Government of Canada as the owner of the vast majority of Canada Lands, through the operation and maintenance of the Canada Lands Survey System. Canada Lands are defined in the Canada Lands Surveys Act and include approximately 2600 Indian Reserves, the National Parks system, the offshore areas of Canada, and both private and Crown lands in the Yukon, Northwest Territories and Nunavut.

The Surveyor General's Office sets, maintains and updates survey standards, maintains and provides access to the Canada Lands Survey Records, establishes a regulatory regime, and manages both the digital cadastral databases and ground-based survey frameworks. The regulatory regime includes the issuance of survey instructions, quality monitoring of surveys and survey products, and the ratification and confirmation of surveys and survey plans.

The primary objective of the Canada Lands Survey System is to provide the foundation to establish property rights on Canada Lands, by defining, describing and documenting the extent of all land interests. An additional objective is to provide standards for customized survey products for land-interest holders, as required.

Certain activities are linked to the management of the land survey programs of administering departments, as required under Section 25 of the Canada Lands Surveys Act. These are managed separately, as part of the ESS issues-driven programs described previously in this plan.

Budget for FY 2003/2004: $4.7 M

Actual expenditures FY 2003/2004: $4.7 M

Committed Outcomes

Effective and efficient land administration for, and by, Aboriginal and northern communities, national parks and offshore administrators, and any land-interest holder or prospective land-interest holder on Canada Lands

Unambiguous definition of the extent of property ownership in support of peaceful and unimpeded sustainable resource and community development

Economic development on Canada Lands

Committed Outputs	Results Accomplished to Date
Comprehensive survey system standards, instructions, guidelines, quality monitoring, signed partnership agreements, and access to the Canada Lands Survey System for clients, stakeholders and users	The *e-Edition* of the Manual of Instructions for the Survey of Canada Lands is now available. It can be amended in near-real-time, without expensive printing and duplication. A new Interdepartmental Agreement has been signed with INAC. The agreement supports the application of flexible standards for legal surveys on Indian Reserves. In collaboration with the Canadian Council on Geomatics, a set of principles has been prepared to support integration of legal surveys into a common reference framework.
Clearly defined, described and delineated boundaries, including the ground-based property boundary fabric	Over 4000 property parcels have been added to the Cadastral Framework in 2003/2004.
Standards for a range of survey products produced for land-interest holders adapted to each of the 23 property-rights systems, and appropriate to each land transaction to meet local tenure and system requirements	Several standards have been developed, including new standards for legal surveys made under the Indian Oil and Gas Regulations.

National Earthquake Monitoring System

The National Earthquake Monitoring System manages a network of over 130 seismograph stations across Canada and is co-located with strong ground-motion recorders at many sites. The service provides reliable, timely seismic data from earthquakes. These data are transmitted to mirrored data centres in Ottawa and Sidney, B.C. The System also provides information for the timely production of automatic and manually analysed seismic data for earthquake and tsunami hazard assessment, and emergency planning and response. The System incorporates data from international and university networks. As required by the Emergency Preparedness Act and the Federal Policy on Emergencies, the System provides information and advice related to the probable or actual occurrence and intensity of earthquakes and tsunamis to federal, provincial, municipal and private-sector emergency-measures organizations.

The System provides real-time data to the U.S. National Oceanographic and Atmospheric Administration's Pacific Tsunami Warning Centre and the International Seismological Centre, and maintains a publicly Web-accessible data archive for research and emergency management.

Currently funded from Natural Hazards and Emergency Response Program

Committed Outcome

More effective earthquake and tsunami emergency preparedness and response, with the potential to reduce human loss and property damage, through reliable and timely information

Committed Outputs	Results Accomplished to Date
A public Web-accessible seismic data archive	Responded to over 250 000 requests for data services.
Reliable and timely automatic and manually analysed seismic data meeting international standards	Approximately 96 percent of data are available from the Canadian National Seismograph Network. Detected and located 3380 seismic events in Canada. Participated in the Roche Brisée II exercise. Earthquake-shake information was supplied as maps through the emergency mapping team, and landslide information was relayed directly from landslide experts to Office of Critical Infrastructure Protection and Emergency Preparedness (OCIPEP). As a result of the exercise, the ESS Natural Hazards Emergency Response Program has begun to develop a way to effectively integrate seismic shaking information with geomatics and geological map information.

Geomagnetic Monitoring Service

The Geomagnetic Monitoring Service comprises 13 magnetic observatories of the Canadian Magnetic Observatory Network, plus associated maintenance facilities. The observatory network monitors both long-term and rapid fluctuations in the Earth's magnetic field in all regions of the country, on a continuous basis. It provides this information in order to forecast solar-induced electromagnetic activity that could damage critical infrastructure, such as communications satellites, power-transmission facilities and pipelines, and to develop the Canadian Geomagnetic Reference Field necessary for safe terrestrial, marine and aeronautical navigation. As required by the Emergency Preparedness Act and the Federal Policy on Emergencies, the service provides information and advice related to the probable or actual occurrence and intensity of electromagnetic storms to federal, provincial, municipal and private-sector emergency-measures organizations.

The Service provides data to the International Real-time Magnetic Observatory Network INTERMAGNET) and maintains a publicly Web-accessible data archive for research and emergency management.

Currently funded from Natural Hazards and Emergency Response Program

Committed Outcome

> Effective emergency preparedness and response for electromagnetic, with the potential to reduce human loss and property damage, storms through reliable and timely information

Committed Outputs	Results Accomplished to Date
A public Web-accessible geomagnetic data archive	Data are more easily downloadable via ESS Web site due to an improved user interface. For the 12 months ending December 2003, the number of requests for data exceeded 27 000; requests for data plots exceed 45 000; requests for derived indices exceeded 26 000.
Reliable and timely geomagnetic data meeting international standards	The Web site has been modified to allow selected clients access to real-time data. As an alternative to transfer of data by geostationary satellite, ESS has installed Internet access at two observatories.

Nuclear Test-Ban Treaty Monitoring

NRCan, through ESS, together with the Department of Foreign Affairs and International Trade, and Health Canada, form the National Authority for the Comprehensive Test-Ban Treaty (CTBT). As required by the CTBT Implementation Act and an agreement between Canada and the Preparatory Commission for the Comprehensive Test-Ban Treaty Organization (CTBTO), ESS operates 11 stations of the International Monitoring System (IMS) and provides seismological, hydroacoustic and infrasound data, in accordance to agreed procedures to the CTBTO's International Data Centre in Vienna. ESS also maintains a National Data Centre for the National Authority, participates in nuclear-explosion event-identification exercises, in the technical meetings of the CTBTO, as needed, and leads the Canadian participation in the CTBTO in the areas of seismic, hydroacoustic and infrasound technologies, and the International Data Centre concerning infrastructure and communications.

Currently funded from Natural Hazards and Emergency Response Program

Committed Outcome

Canadian foreign-policy commitment to the non-proliferation of nuclear weapons is fully demonstrated, through providing reliable information and expert advice on nuclear explosion events and assisting the establishment of an effective multilateral agency (i.e., CTBTO).

Committed Output	Results Accomplished to Date
Seismological, hydroacoustic and infrasound data from Canadian International Monitoring Systems stations in accordance to agreed procedures	Four of eleven Canadian stations have been certified to date as meeting international standards. Approximately 98 percent of data are available. 98 percent of communications circuit are available. 209 598 data requests have been satisfied.

4.0 Who and What We Are

The Earth Sciences Sector comprises:

- Geomatics Canada – provides authoritative and timely spatial positioning, legal surveys, maps, remotely sensed data and geographically referenced information describing the Canadian landmass and offshore territory;
- Geological Survey of Canada – Canada's national agency for geoscience information and research, building a comprehensive geoscience knowledge base about Canada's landmass and offshore interests;
- Polar Continental Shelf Project – operates a logistics support network for scientists conducting a wide variety of research in the Canadian Arctic; and
- ESS Corporate Services – supports Sector and departmental activities.

The Sector has a strong presence across Canada, with regional offices in every province and territory except New Brunswick, Prince Edward Island, and Newfoundland and Labrador.

Geomatics Canada

Geomatics Canada (GC) is recognized internationally for providing world-class geomatics information using sophisticated technology. GC delivers quality products and services that describe the Canadian landmass in the form of surveys, maps, remotely sensed data and geographically referenced information. Geomatics information has a wide range of applications, from emergency response systems to crop management to resource-development planning. GC programs are delivered through the Legal Surveys Division and International Boundary Commission, the Canada Centre for Remote Sensing (CCRS), Mapping Services Branch and the GeoConnections Secretariat.

The Legal Surveys Division, under the Canada Lands Surveys Act and other legislation, is responsible for the Canada Lands Survey System and for carrying out surveys on Canada Lands at the request of administering departments. It is also responsible for the massive survey programs associated with the implementation of Aboriginal Land Claims. The International Boundary Commission, also located in this Division, has responsibility for the International Boundary Maintenance and 1925 Treaty Implementation Program, and executes its responsibilities in partnership with its American counterpart.

The Canada Centre for Remote Sensing provides a national service for receiving, processing, archiving and disseminating remotely sensed space-based data for Canada. CCRS develops Earth Observation applications to meet other federal government departments' needs by defining, translating and delivering user requirements for Earth Observation in Canada. CCRS works closely with the Canadian Space Agency and others to develop concepts for

remote-sensing missions to meet Canada's needs. In addition, CCRS is responsible for the maintenance of, and access to, the national geodetic framework.

The Mapping Services Branch acquires, manages and disseminates topographic and toponymic (geographic name data) information for the Canadian landmass, and the production of aeronautical charts for Canadian civil and military aviation.

For more information about Geomatics Canada, see http://www.nrcan.gc.ca/ess/index_e.php.

The Geological Survey of Canada (GSC) delivers geoscientific knowledge of Canada's landmass and offshore to serve the needs of Canadians, including the private sector and various levels of government.

The GSC consists of the Minerals and Regional Geosciences Branch, and the Sedimentary and Marine Geosciences Branch. The Minerals and Regional Geosciences Branch consists of three divisions: the Continental Geosciences Division and the Mineral Resources Division (Ottawa) and GSC Pacific (which has offices in Sidney and Vancouver, British Columbia, and Ottawa). The Sedimentary and Marine Geosciences Branch consists of four divisions: the Terrain Sciences Division (Ottawa), GSC Atlantic (Dartmouth, Nova Scotia), GSC Quebec (Sainte-Foy, Quebec) and GSC Calgary (Alberta). The GSC also is a partner with Indian and Northern Affairs Canada and the Nunavut Department of Sustainable Development in the Canada–Nunavut Geoscience Office in Iqaluit, and manages the Office on behalf of the partners.

The GSC provides knowledge about the geology of the Canadian landmass and offshore through working partnerships with the academic, government and private sectors. This knowledge informs decisions related to the sustainable development of Canada's mineral, energy and groundwater resources, environmental stewardship, and issues of public health and safety. The understanding of the regional geological framework of Canada is integral to promoting the exploration for, and discovery of, new resources.

Working with other federal agencies, GSC's ocean-mapping activities promote sound offshore infrastructure development and protection of marine habitat, and support Canadian territorial interests under the Law of the Sea. GSC expertise is also used in understanding natural hazards and geological processes that affect the environment. The GSC operates Canada's seismograph network that is essential to managing the risks posed by earthquakes, and also underpins Canada's commitments to monitoring nuclear explosions under the Comprehensive Test Ban Treaty. Similarly, the geomagnetic network provides advance warning of magnetic storms, and supports research on the impact of magnetic fields on energy-transmission systems. GSC is the lead federal agency in a new initiative to reduce the significant losses resulting from landslides each year in Canada. Research on the impacts of the changing climate on coastlines, permafrost and groundwater resources are assisting Canadians in adapting to this challenge.

For more information about the Geological Survey of Canada, see http://www.nrcan.gc.ca/ess/index_e.php.

4.3 SECTOR CORPORATE SERVICES

The Policy, Planning and Coordination Division provides corporate support to ESS and NRCan in the areas of policy analysis and development, strategic planning and reporting, and coordination.

The International Division is responsible for international business-development activities of the Sector, including promoting business opportunities for Canadian companies, using Sector skill bases to assist developing countries, and coordinating efforts and monitoring issues related to trade and investment.

To further solidify the cross-sectoral programs of ESS, the former GSC and GC Offices have been merged into the ESS Office. The Office is charged with a key role in transforming the Sector into a more integrated, top-down, issues-driven, high-performance organization. It promotes integration and synergy through the project selection and review process.

The ESS Info Division provides leadership and a central focus for the information functions of the Sector. It provides library services through the Earth Sciences Information Centre, which maintains a comprehensive collection of geoscience and geomatics information for the use of all Canadians. The Division also publishes and distributes GSC's scientific series output.

The Sector is moving toward a shared service model for its corporate service in finance, administration, human resources and information technology. This move to a shared service model allows for the effective leveraging of resources and the sharing of best practices, with the goal of reducing costs while improving service.

The ESS Financial and Administrative Services Division delivers services to all parts of the Sector, providing services to programs and logistical support to field projects. The ESS IT group delivers standard desktop computing computers, networks, e-mail and Web services. Human-resource services are provided to ESS through a shared-services agreement with the department's Corporate Services Sector.

The ESS Communications Group, in partnership with ESS programs, branches and divisions, promotes the innovative work that takes place in the Earth Sciences Sector, both inside and outside the department. The ESS Communications Group provides strategic advice and services that support ESS's publications activities and its internal communications.

5.0 Ensuring Program Effectiveness Through External Advice

THE COUNCIL OF SCIENCE AND TECHNOLOGY ADVISORS (CSTA) WAS CREATED IN APRIL 1998 TO PROVIDE THE GOVERNMENT OF CANADA WITH EXTERNAL EXPERT ADVICE ON INTERNAL SCIENCE AND TECHNOLOGY ISSUES THAT REQUIRE GOVERNMENT-WIDE STRATEGIC ATTENTION. CSTA WAS CHARGED WITH RECOMMENDING WAYS TO IMPROVE THE EFFECTIVENESS OF S&T CONDUCTED WITHIN THE CANADIAN GOVERNMENT. THE ESS S&T STRATEGY, WHICH IS AIMED AT IMPROVING ESS EFFECTIVENESS AT PROVIDING KNOWLEDGE AND SERVICES TO CANADIANS, REFLECTS A STRONG COMMITMENT TO THE KEY RECOMMENDATIONS OF THE CSTA REGARDING ALIGNMENT, LINKAGES AND EXCELLENCE.

The Earth Sciences Sector benefits from advice from a wide range of groups, at various levels. ESS advisory bodies include program-specific and ad hoc committees, as well as standing committees and related external committees. Examples of these advisory bodies include the Minister's National Advisory Board on Earth Sciences (MNABES), the Geological Survey of Canada Advisory Committee, the Geomatics Canada Advisory Committee, the Polar Continental Shelf Project Advisory Board, the National Geological Surveys Committee, the GeoConnections Management Board, and the Canadian Council on Geomatics. Recommendations from these committees help guide the activities of the Sector as it continues to implement the ESS S&T Strategy.

In response to recommendations made in 2002 by MNABES, the Minister approved changes to the Board's structure, so as to provide him with strategic advice on ESS-wide issues. Specifically, a two-level advisory structure was put in place, comprising MNABES reporting to the Minister and providing strategic advice on ESS as a whole; and three advisory committees reporting to the ESS Assistant Deputy Minister and with Chairs sitting on MNABES, providing advice related to the program activities of the Sector.

6.0 PARTNERSHIPS

ESS DELIVERS MANY OF ITS PROGRAMS THROUGH PARTNERSHIPS WITH OTHER GOVERNMENTS, ACADEMIA, INDUSTRY AND STAKEHOLDERS, FORMING A STRONG S&T-ORIENTED EARTH-SCIENCES NETWORK. ESS FOCUSES ON THOSE ACTIVITIES IT IS BEST SUITED TO PERFORM EFFECTIVELY AND EFFICIENTLY. THUS, ESS CONTRIBUTES TO THE FOUNDATION OF S&T KNOWLEDGE AND INFORMATION, AND AT THE SAME TIME FOSTERS AND FACILITATES CONTRIBUTIONS FROM PARTNERS IN S&T INNOVATION. THE SECTOR'S EXPERTISE AND STRONG LINKAGES WITH THE BROADER S&T COMMUNITY HELP ENSURE THE RIGHT S&T IS BEING PROVIDED AT THE RIGHT TIME TO MEET THE NEEDS OF NRCan, THE GOVERNMENT OF CANADA, THE PRIVATE SECTOR AND THE CANADIAN PUBLIC. THIS APPROACH ALSO ENSURES INCREASED EFFICIENCY AND REDUCED DUPLICATION OF EFFORT.

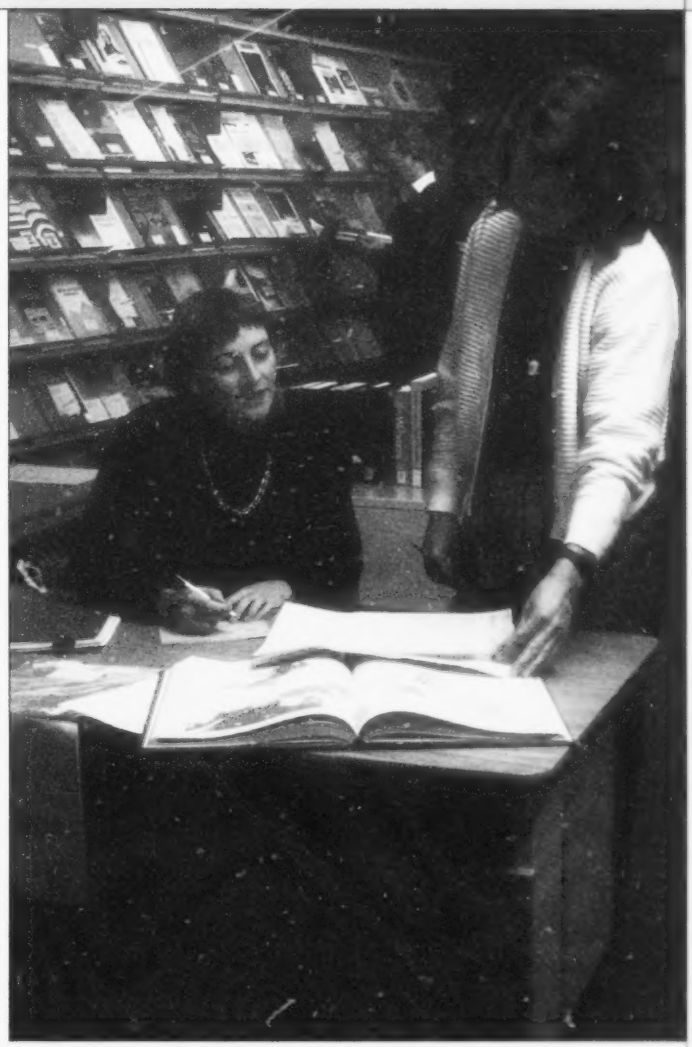
ESS PRIVATE SECTOR

Geospatial information has a wide range of applications, from emergency response to crop management and resource development. The Sector's knowledge and expertise provide Canadian companies with the information and tools they need to compete internationally and to take advantage of global opportunities, presented by an increasingly technology-driven economy.

Canadian geomatics and geoscience industries produce high-quality products and services that are in demand throughout the world. ESS provides leadership by working with Canadian geomatics and geoscience companies to identify global business opportunities and by leading departmentally sponsored trade missions to targeted countries. In addition, the Sector makes its expertise available on both a collaborative and cost-recovery basis. In the case of collaborative projects, it works closely with partners, sharing costs and expertise on projects of mutual interest. In addition, the Sector contracts out more than $37 M annually to industry for map products, cadastral surveys, aircraft fuel, remote-sensing services, printing and publishing, etc.

Through collaboration with ESS, Canadian industry has achieved an international reputation for leadership, as demonstrated by numerous successful partnerships with members of the global geomatics and geoscience community. ESS staff are also directly involved in many international projects, including the Northeastern Brazil Groundwater Project and the Tunisian GÉONAT Project mentioned earlier.

EARTH SCIENCES SECTOR



Strategic alliances with other provincial and territorial governments and First Nations are critical to the Sector's ability to carry out its responsibilities. The partnership between the federal and territorial governments in establishing the Canada–Nunavut Geoscience Office in Iqaluit is an excellent example of this strategic approach to national issues, providing information on, and promoting geoscience activity in, Canada's newest territory.

The Intergovernmental Geoscience Accord ensures that governments in Canada will continue to work together to give Canadians accurate geoscience information, by fostering good working relationships among government geological survey organizations. Progress on signing the Canadian Geomatics Accord with federal agencies, and provincial and territorial governments, has been excellent, with fifteen signatories to March 31, 2004 and additional signatures anticipated.

The Sector is also a member of the Inter-Agency Committee on Geomatics (IACG) and the Canadian Council on Geomatics (CCOG). The IACG comprises members from a wide variety of federal government departments and agencies, that are collaborating to guide development of the Canadian Geospatial Data Infrastructure. CCOG is a federal–provincial geomatics group dedicated to building partnerships, sharing information, data and related activities.

ESS's Innovation Acceleration Centre represents a new business model between industry and government research. Administered by the Canada Centre for Remote Sensing (CCRS), the IAC helps Canadian companies develop geomatics and geoscience products and services by transferring technology and providing technical expertise. The IAC, in itself, is innovative by offering supportive collaboration coast-to-coast through an on-line model of participation.

The GeoBase portal, located at http://www.geobase.ca, was launched

in November 2003 to provide Canadians with access to quality and unique geospatial data at no cost and with unrestricted use. The GeoBase portal is the first output stemming from the GeoBase initiative, a coalition of federal, provincial and territorial governments, which is overseen by the Canadian Council on Geomatics. The aim of GeoBase is to collect data once closest to the source and utilize those data to meet a number of needs, thereby ensuring the provision and access to a common, up-to-date, and well maintained base of quality geospatial data for all of Canada. NRCan plays a leadership role in GeoBase and is a main contributor to the establishment of the GeoBase portal and contents. It also operates the portal. GeoBase benefits Canadians by providing a federal, provincial and territorial approach to advancing and stimulating the geomatics and other technology sectors. It facilitates the exchange of technical knowledge between industry and governments and improves decision-making by all Canadians by providing a reliable and valuable source of geospatial information.

ESS UNIVERSITIES

Linkages between ESS and Canadian universities have always been an important aspect of the Sector's R&D program. These linkages are aimed at maximizing the use of resources to meet national needs for Earth-science knowledge and expertise, and developing a sufficient supply of graduates in disciplines of interest to ESS and the Canadian Earth-sciences community.

ESS establishes and maintains close links with Canadian universities in a number of ways. An example of this linkage is the relationship between the GSC Quebec and the Institut national de la recherche scientific (INRS). Together, they have formed a co-located government–university partnership whose work contributes to issues related to groundwater, climate change, and mineral and energy resources. Another form of linkage is through direct expenditures, such as contracts for acquiring goods and services; grants and contributions; collaborative research projects involving universities and other partners; logistical support; and targeted research programs.

The ESS Postgraduate Scholarship Supplement promotes graduate research in Earth sciences in Canadian universities. It encourages ESS linkages with universities by insisting that graduate students carry out all or part of their research in conjunction with the Sector. Further, an ESS research scientist must be on the student's supervisory committee.

The Geomatics Canada Scholarship Program, funded by the Sector and administered by the Canadian Institute of Geomatics, promotes the study of geomatics, furthers the education and training of students in the field, and encourages the research work that will further Canada's position in the international marketplace.

Another way in which ESS supports this relationship is through in-kind contributions, such as time spent by more than 80 ESS research scientists as adjunct

professors; sharing of laboratory equipment; data and knowledge; delivery of lectures and seminars; supervision of approximately 132 graduate students; participation on university committees; joint publications and reviews of university manuscripts; staff exchanges; and shared access to data, collections and research samples.

These interactions lay the foundation for strong ESS–university partnerships, and enable the Sector and Canadian universities to maximize their intellectual and operational resources. ESS will continue to strengthen its all-important relationship with Canadian universities over the three-year planning period.

7.0 Earth Sciences Sector Funding

Appropriation Funding by Major Category of Expenditure

	2003-04 ($000)	2004-05 ($000)	2005-06 ($000)
Salaries (1,415 FTEs* in 2003-04)	86,497	87,212	86,666
Employee Benefit Plan	17,299	18,750	18,631
Operating and Capital Expenditures	69,432	70,075	53,098
Grants and contributions	12,959	8,729	6,690
Total ($000)	**186,187**	**184,766**	**165,085**

Funding by Major Component

	2003-04 ($000)	2004-05 ($000)	2005-06 ($000)
Geomatics Canada	82,558	73,874	62,082
Geological Survey of Canada	75,229	79,295	71,308
Polar Continental Shelf Project	3,579	6,501	6,501
Corporate Services	24,821	25,096	25,194
Total ($000)	**186,187**	**184,766**	**165,085**

*FTE = Full Time Equivalent

8.0 Earth Sciences Sector Across Canada

9.0 Earth Sciences Sector Key Contacts

Assistant Deputy Minister's Office
580 Booth Street, 14th Floor
Ottawa, Ontario K1A 0E4
Telephone: (613) 992-9983
Fax: (613) 992-8874

Earth Sciences Information Centre
601 Booth Street, 3rd Floor
Ottawa, Ontario K1A 0E8
Telephone: (613) 996-3919
Fax: (613) 943-8742

Mapping Services Branch
615 Booth Street, 7th Floor
Ottawa, Ontario K1A 0E9
Telephone: (613) 947-0793
Fax: (613) 995-2000

Canada Centre for Remote Sensing
588 Booth Street, 3rd Floor
Ottawa, Ontario K1A 0Y7
Telephone: (613) 947-1222
Fax: (613) 947-1382

Legal Surveys Division and International Boundary Commission
615 Booth Street, 5th Floor
Ottawa, Ontario K1A 0E9
Telephone: (613) 995-4341
Fax: (613) 992-1122

Climate Change Impacts and Adaptation Directorate
601 Booth Street, 1st Floor
Ottawa, Ontario K1A 0E9
Telephone: (613) 947-4880
Fax: (613) 992-0190

Sedimentary and Marine Geoscience Branch
601 Booth Street, 2nd Floor
Ottawa, Ontario K1A 0E8
Telephone: (613) 995-2340
Fax: (613) 996-6575

Minerals and Regional Geoscience Branch
601 Booth Street, 2nd Floor
Ottawa, Ontario K1A 0E8
Telephone: (613) 995-4093
Fax: (613) 996-6575

Polar Continental Shelf Project
615 Booth Street, 4th Floor
Ottawa, Ontario K1A 0E9
Telephone: (613) 947-1601
Fax: (613) 947-1611

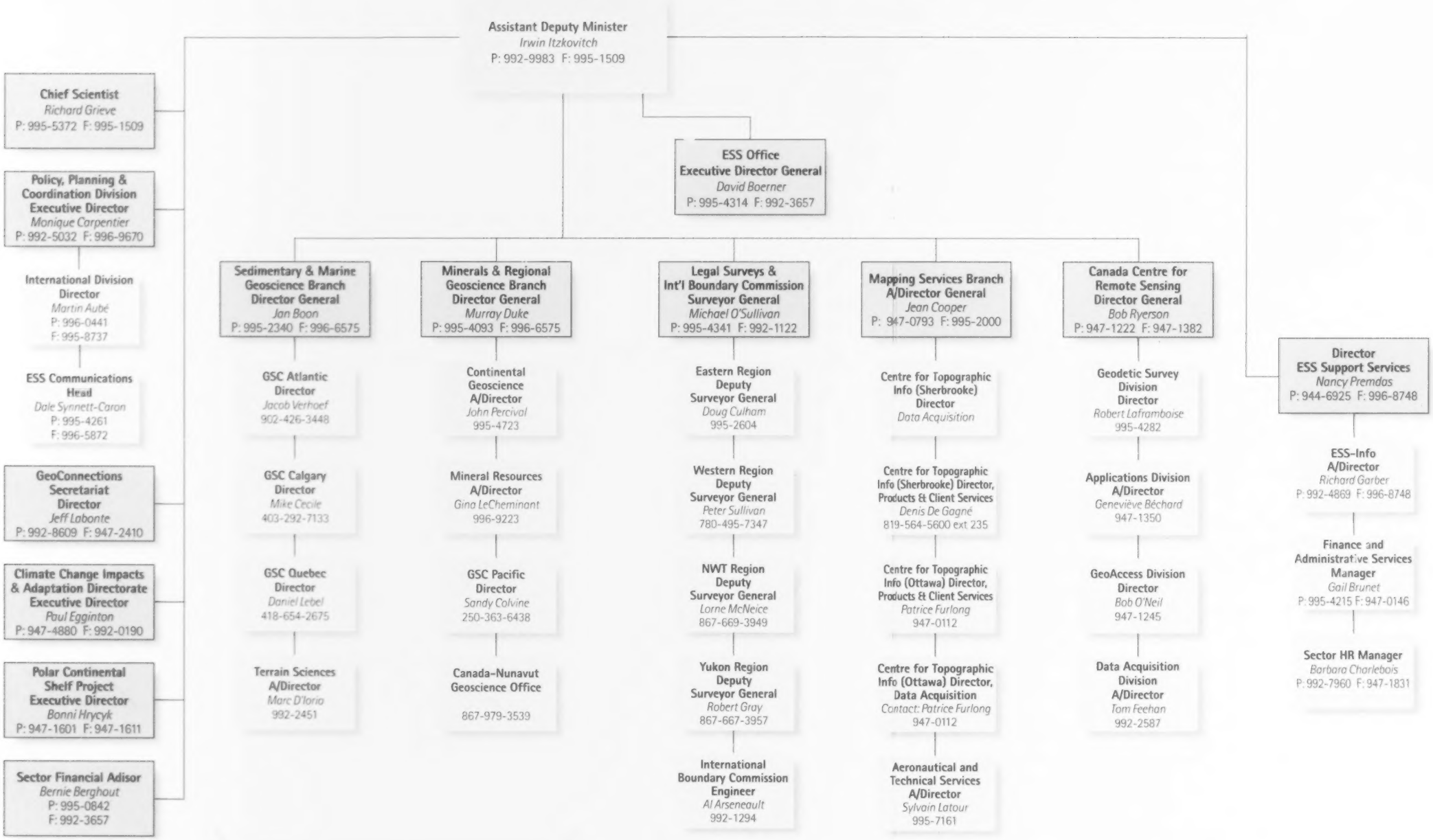
Policy, Planning and Coordination Division
580 Booth Street, 14th Floor
Ottawa, Ontario K1A 0E4
Telephone: (613) 992-5032
Fax: (613) 996-7862

International Division
615 Booth Street, 5th Floor
Ottawa, Ontario K1A 0E9
Telephone: (613) 996-7643
Fax: (613) 995-8737

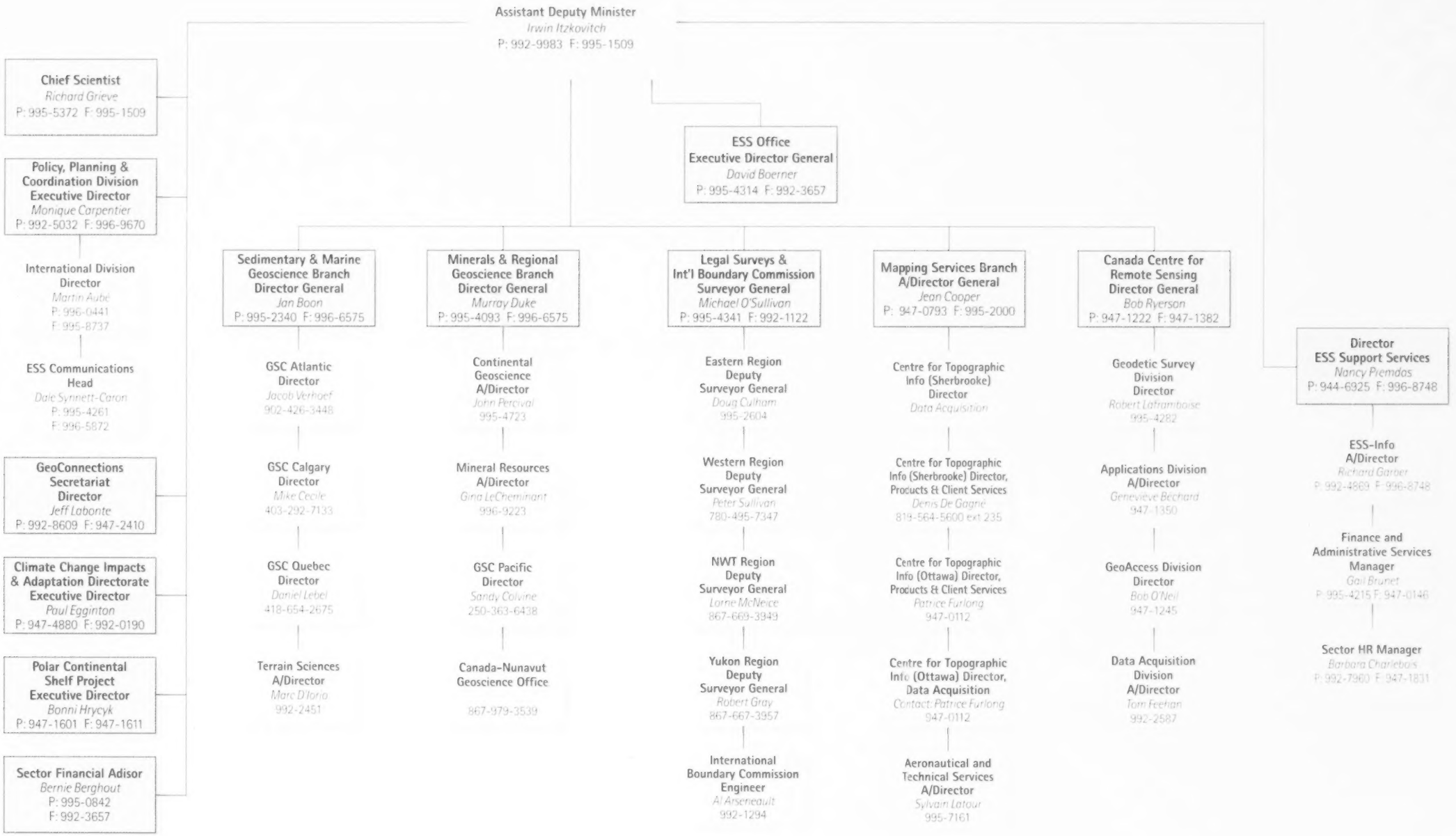
GeoConnections Secretariat
615 Booth Street, 6th Floor
Ottawa, Ontario K1A 0E9
Telephone: (613) 992-8609
Fax: (613) 947-2410

ESS Communications Group
588 Booth Street, 3rd Floor
Ottawa, Ontario K1A 0Y7
Telephone: (613) 995-4261
Fax: (613) 996-5872

10.0 Earth Sciences Sector – Organization Chart – as of May 4, 2004



10.0 Earth Sciences Sector – Organization Chart – as of May 4, 2004



EARTH SCIENCES SECTOR

Vision

ESS will be, and be recognized to be, a leader in the development, deployment and integration of science and technology into policy and decision-making by NRCan, the federal and provincial governments, industry and other stakeholders.

Strategy

- Have and maintain a highly motivated innovative and focused staff;
- Have a balanced S&T portfolio;
- Do the right S&T and do it at the right time;
- Own only what you must; influence all you can; and
- Use the best resource where ever they exist through the use of internal and external networks, partnerships and alliances.

Implementation

ESS will be a high-performance, issues-, outputs- and outcomes-driven organization, aligned with government priorities, linked with other parts of Canada's innovation system, and known for excellence in everything it does making it the employer of choice.